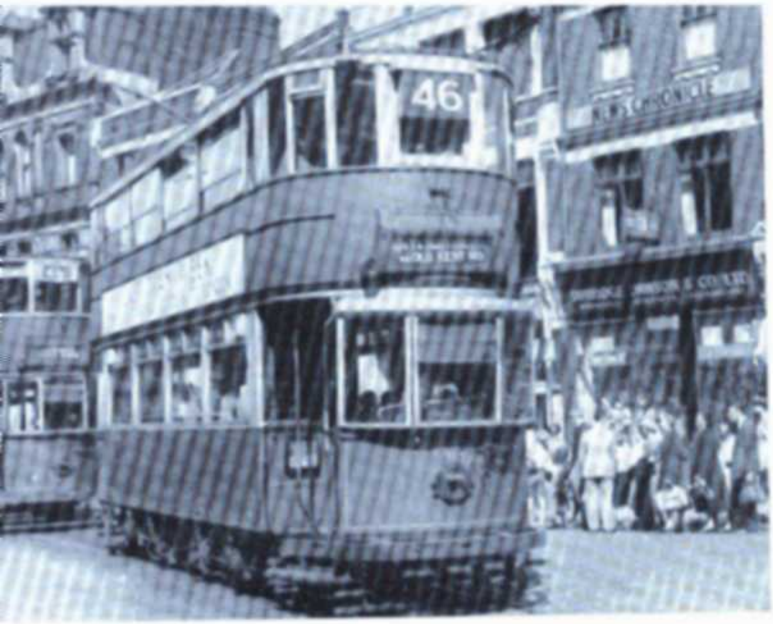
Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED



MODELLING A TRAM

— New serial

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Contents

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Cover picture

Ten years ago trams disappeared from the streets of London. Here are three in the familiar London Transport livery. On page 507 Terry Russell begins a short serial on the construction of a model tramcar

Next week

In a few weeks the traction engine rally will be with us again. Next week Robin Orchard whets our appetite for the events that will be served up with illustrations and information on some well-known engines

Smoke Rings

A weekly commentary by VULCAN

THE " good old days " are often the subject of nostalgic comment by some of our readers who often refer to articles published in early volumes of MODEL ENGINEER and to the series of 6d. handbooks which offered so much practical introduction to the many skills associated with the hobby.

Though they were intended for beginners they contained a lot of useful information and I know at least one library of a professional institution which has many of the original ME handbooks on its shelves.

In fact, we sometimes get asked by research engineers for an old copy of one of these books, for it probably contains one of the few references to some obscure, but elementary, engineering problem. I am afraid that we can seldom oblige, for with few exceptions they are all out of print.

Popular titles

However, the Book Department is considering the re-issue of some popular titles and it is possible that one or two of the others may be abridged in serial form for the benefit of MODEL ENGINEER readers.

There is no doubt that the instruction gained from these sources in the old days often led to an engineering career.

The head of a progressive engineering firm, who recently asked for assistance in finding old volumes of ME to fill gaps in a complete set, said he regarded the magazine and its associated instruction books as an inexhaustible source of information on all aspects of engineering practice.

Another old reader told me, " I have been taking your magazine since the 18th century! "

Though ME can claim descent from a long line of engineering journals, its publication began in 1898. Nevertheless, I congratulate this reader on his longevity.

Building Springbok

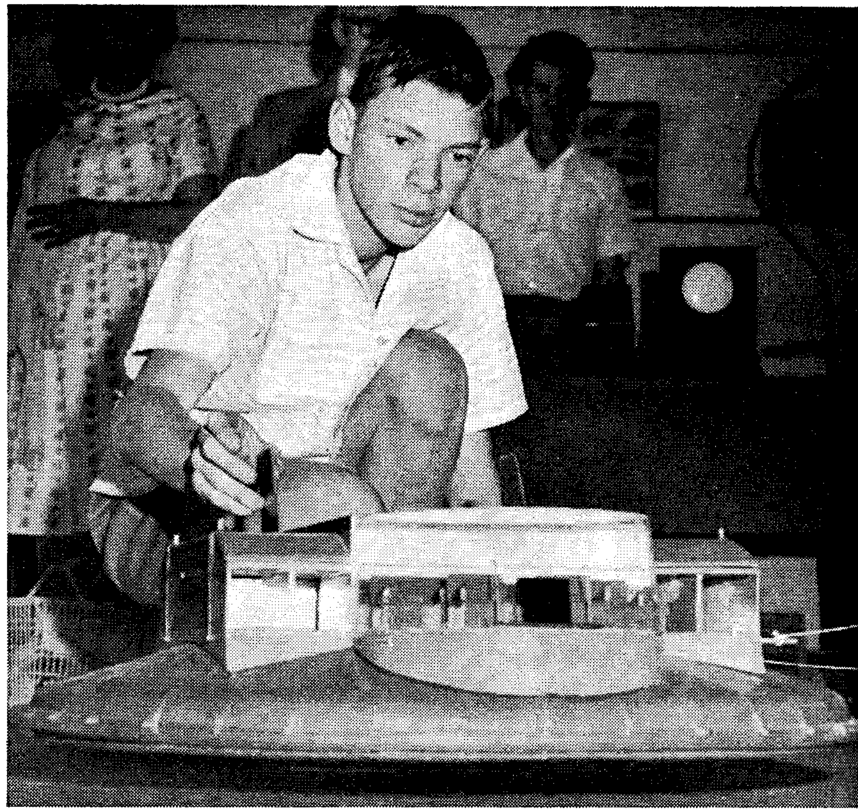
MR E. C. DEARMAN, of Sydney, Australia, is building a *Springbok* and he has just applied to the New South Wales Department of Labour and Industry for a certificate to haul passengers. In a short article next week he will describe some of the work he has done on the model.

Meanwhile, I thought you might like to know that Mr Dearman's locomotive was on show at a recent meeting of the Inventors Association of Australia in Arncliffe, Sydney. He took it there at the request of the president, Mr George Menzies, who is also building a *Springbok.*

Hovercraft

I hear from Mr Dearman, too, that hovercraft are arousing interest in Australia. Sixteen-year-old Mr Doctors, of Bondi, Sydney, has built a fine model of one from plans kindly supplied by Messrs Saunders Roe.

It was successfully demonstrated running on a circular course, during which it cleared small objects, such as tools, put on the floor. It is said that the ground clearance was 2 in., which sounds very good to me.



Sixteen-year-old Mr Doctors, of Bondi, Sydney, demonstrates his large model of a hovercraft

Modelling a London TRAMCAR

The last trams ran in the Capital in 1952. But they are not forgotten. Enthusiasts keep their memory alive with highly-detailed working models. In this serial T. M. Russell tells how to build a gauge O car

THE tram has all but disappeared from the British scene. The familiar grind of motors and swishing of wires has given way to the throbbing diesel engine.

At one time nearly every major town or city had a tramway, now the cars have nearly all vanished. But interest in trams has probably never been higher, and modelling of the vehicles has grown into a large hobby.

Some enthusiasts prefer large scale versions, but there are many who do not have the space to operate the bigger models. I think that gauge O is as small as one need go.

Before modelling a tram in this scale it is advisable to join the Tramway and Light Railway gauge O group. Members can be of enormous assistance to the newcomer.

Last year was the centenary of the London tramways so I decided to build the popular London County Council E3 type car. But with a little adaption the instructions in this serial can be used to model almost any tram. Essentials before you begin are a good photograph and a reasonably fine detail drawing. Mine is a scaled-down plan from the original general arrangement drawing.

You will see that it is a double drawing covering both the E3 and HR2 type cars. The E3s had double trolleys, metal windscreens, traction trucks and a standard brake handle. They were numbered 160-210 and 1904-2004. Over the years many of the cars were given wooden windscreens and lost the rubbing strips along the lower deck sides.

The HR2 cars had double trolleys, wooden windscreens, equal wheel trucks and slipper brake handle with the wheel around it. They were numbered 1854 to 1897. There was also a version of the HR2s without trolley poles, but having equal wheel trucks and metal windscreens. These were numbered 101 to 159.

For making the model you will require two sheets of Bristol board (one 1/32 in. thick, and the other $\frac{1}{16}$ in.), three sheets of obechi ($\frac{1}{16}$ in. thick, 3/32 in. and $\frac{1}{8}$ in.), a tube of Evostik and one of Britfix, two sheets of celluloid and some shellac.

The card should be shellacked after assembly to increase strength. You will also need round, flat and knife-edge Swiss files and fine sandpaper. For the painting I recommend Humbrol paints; they are by far the best. The obechi, Bristol board and celluloid can be obtained from a good model or art shop and the shellac can be bought at a paint dealers.

For cutting wood and card I use Ever-Ready or Star razor blades, as they have a substantial back on them and are reasonably safe.

Construction is started by first making a box of the lower saloon floor, ceiling and bulkheads. The ceiling also forms the upper deck floor and will, therefore, extend over the platform. The platform is fitted later to the ends of the box, and the dash and windscreen are fixed around the edge. The upper deck sides and curved ends are fixed around the edge and the roof put on top.

First cut out the lower deck floor from $\frac{1}{8}$ in. obechi and cut a hole in it to clear the tops of the driving wheels and motor, allowing for swing on curves. The sides and bulkheads are constructed on the sandwich system; that is, sandwiches of card-celluloid-card.

Make four outer side panels from 1/32 in. Bristol board and cut out the window openings. Cut two pieces of celluloid the same size and make up two sandwiches, using Evostik. Many adhesives will eat into the celluloid and ruin the finish. An obechi rail, $\frac{1}{8}$ in. sq., is stuck along the inside to take the seats.

The end bulkheads are made in the same way but for this model yellow glass should be used as in the full-size car. I normally put the sliding doors in the closed position as this helps to keep the dust out, and also gives the

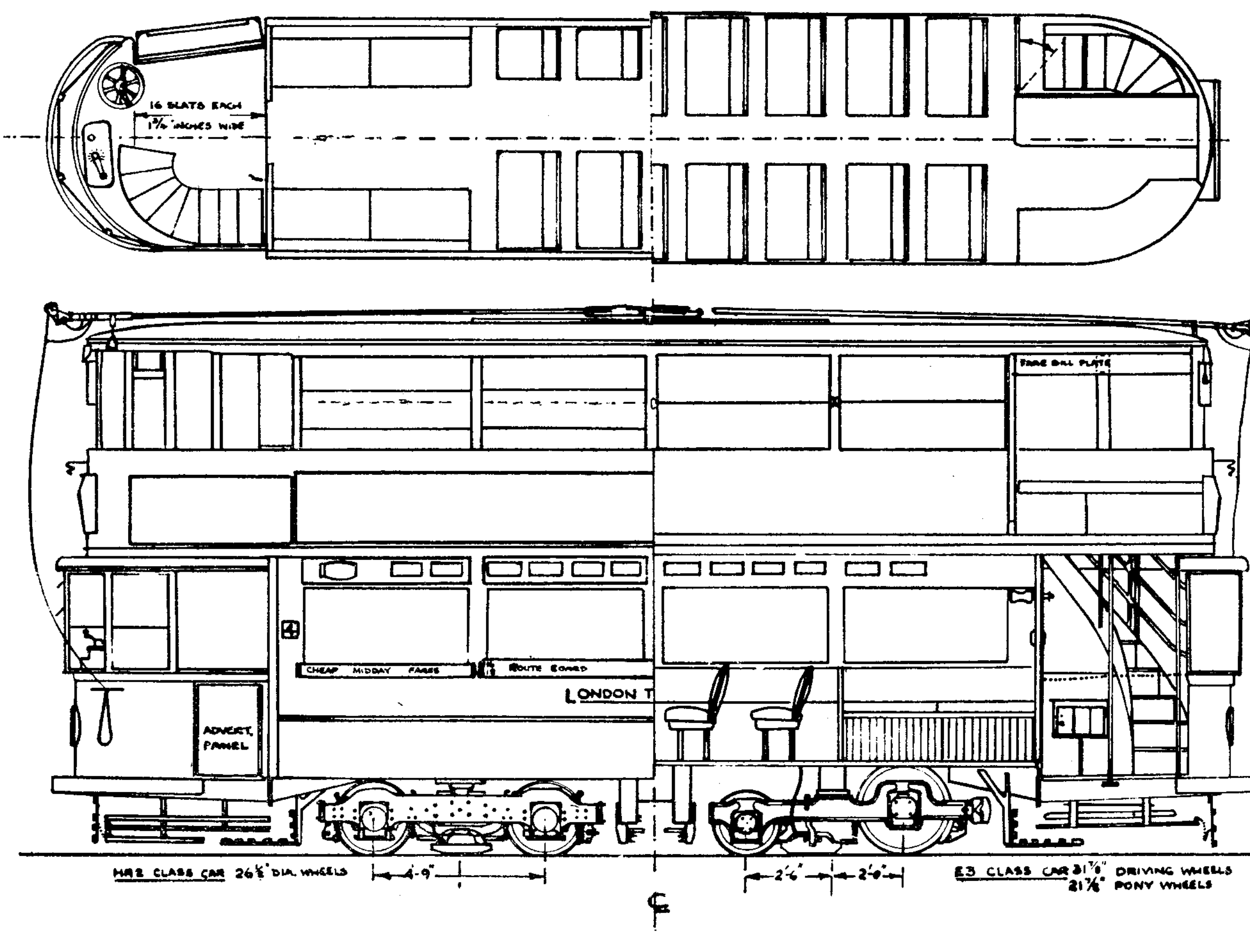
Like a giant insect, antennae at the ready, this HR2, with both trolley arms at one end, whines towards Blackwall Tunnel

model added strength.

The ceiling is made from $\frac{1}{16}$ in. Bristol board. Remember to cut out the stair well before it is fixed. I do not cut this well in the floor as it takes a lot of strength away from the car ends. Instead I suggest it is there by the use of black matt paint. A piece of square obechi, for the sides to fix against, is stuck along the ceiling. The sides and bulkheads should now be shellacked, sanded and painted to completion as these cannot be treated after the box has been made.

If slats are required they should be cut from 1/32 in. Bristol board and fixed down with Britfix. A piece of square obechi should be stuck along the edge for the sides to rest against. This part should be shellacked, sanded and painted.

I find Evostik to be by the far the best adhesive for celluloid and painted surfaces, and Britfix the best for unpainted and unshellacked surfaces. It is not so good on painted surfaces as the glue must be able to grip into the surface of the material.



The sides, ends, floor and ceiling may now be stuck together. If you prefer, you can use obechi in place of the inside layers of card on the sides.

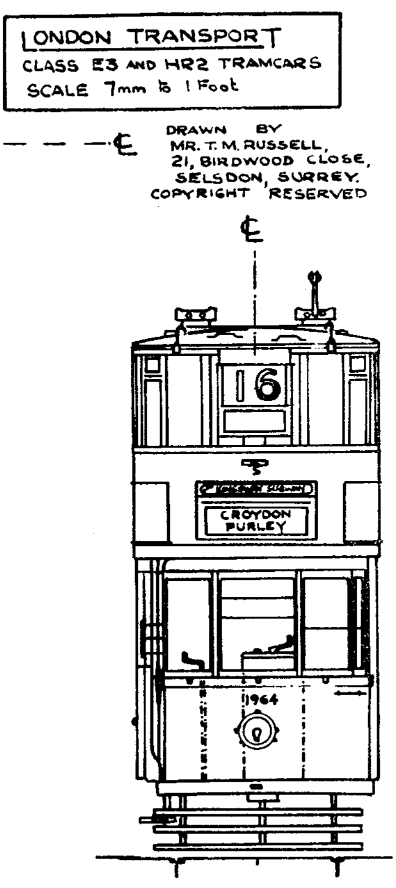
The seat backs are made from $\frac{1}{16}$ in. obechi and the seat bottoms from $\frac{1}{8}$ in. The two are stuck together with Britfix. They can then be painted and fixed to the rail along the car sides. You could, of course, make them more elaborate if you wished.

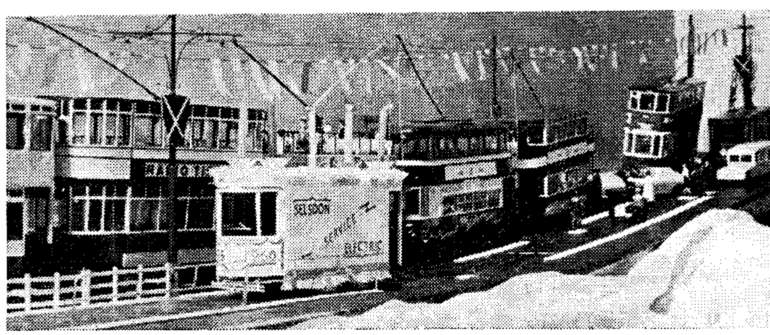
Bearers for the platform are made from $\frac{1}{16}$ in. obechi and they are stuck under the ends of the saloon. There are usually four of these and they extend past the platform ends so that the bumpers can be fixed to their ends.

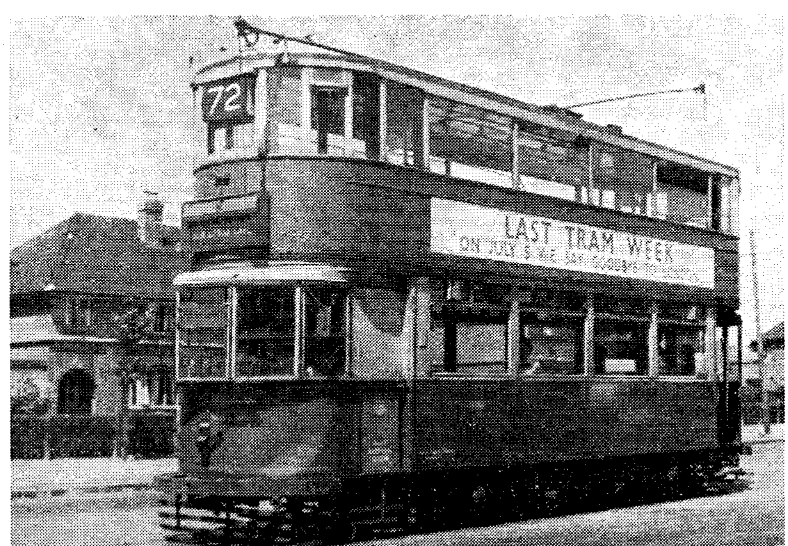
The platform is made from $\frac{1}{16}$ in. Bristol board with slats of 1/32 in. Bristol board stock upon it.

The dash is made from a piece of 1/32 in. Bristol board rolled to shape and stuck to the platform edge with Evostik. This way, you do not have to hold the dash in place while the glue dries. It is best to shellac the Bristol board at this stage as the glue will not stick well to shellacked surfaces.

★ *To be continued on May* 10







Top and bottom pictures show the familiar E3 car, one of the most numerous in the London Transport fleet. Centre illustration shows part of Mr Russell's layout. A fast sports car has just derailed a tram. Ambulance and breakdown car are quickly on the scene

The "Inside-out Rotary"

EDGAR T. WESTBURY compares crank and cam-track engines and examines the new design evolved by Mr A. C. Mercer

IN previous articles on unorthodox engines, I referred to attempts which have been made to dispense with a crankshaft.

The substitute for the normal crank has usually been a swashplate or equivalent device, which produces an axial or arcuate motion of the pistons. Alternatively, there have been a few examples of engines in which the pistons, or extensions thereof, bear directly or indirectly on formed cam tracks which control their order of movement.

This is sometimes done to vary the travel or duration of individual strokes to obtain, theoretically at least, an increase of efficiency. In other cases, multi-lobed cam tracks are used to increase the number of cycles per revolution of the shaft. One such engine employed a wave track on a cylindrical cam which produced eight inward and outward strokes of each piston per revolution—equivalent to using a reduction gear of 8 : 1 ratio.

Generally, such engines have failed to show any improvement over those with conventional cranks and connecting rods—rather the reverse, in fact, because of the lower mechanical efficiency in transmitting motion through cams.

Thrust loads

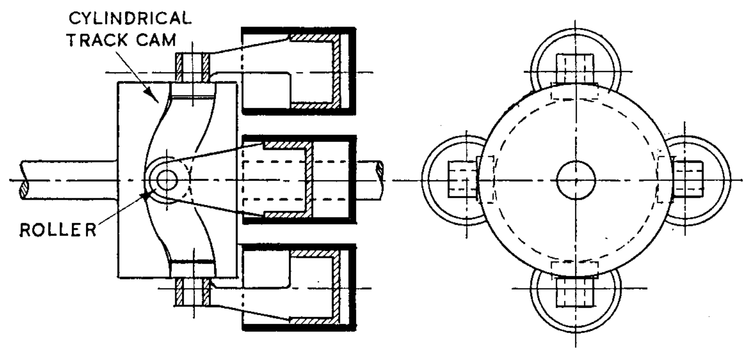
Even when ball or roller races are used as the thrust members, both the axial and side thrusts are difficult to cope with; and so far as i.c. engines are concerned, they have never attained practical success.

At one time, cam-track engines operating on air pressure were popular for portable tools, where compactness was more important than economy, but they have now been superseded by rotary motors of the vane type, which have no reciprocating parts and no valve gear.

Axial piston motion, though usually favoured in cam-track engines, is not an essential feature; some engines have had peripheral cams producing a radial movement of one or more pistons. They are less compact than the axial type, and if the cams are made to control piston movement in both directions, their construction is also more complicated. Complication is often necessary for i.c. engines, though not for single-acting steam or air motors.

Both axial and radial cam-track engines have been made in "static" and "rotary" types; the latter term, as explained in previous articles, is somewhat ambiguous, though in engines with reciprocating pistons, it means that the engine structure rotates, while the crank or camshaft remains stationary. As Einstein told us, it is all a matter of relativity. But it introduces centrifugal force, which can be usefully employed in certain cases, though it is not always an unqualified advantage and may have undesirable effects.

An interesting steam engine produced some years ago employed four pistons tangentially located in a rotating member, the centre of which formed a bearing for a hollow stationary shaft. This served as a steam supply pipe, and was ported to form a rotary admission valve. The rotating member was eccentrically mounted inside a circular casing, the inner surface of which formed a track on which articulated slippers attached to the pistons took their bearing, under the influence of centrifugal force.



Axial-cylinder cam-track engine

Rotation of the member caused the pistons to move inward and outward once per revolution, their stroke being determined by the eccentricity of the casing. Exhaust could be controlled either by ports and passages in the rotary valve, or by uniflow ports uncovered by the pistons. It is probable that the mechanical efficiency of this "tangento-rotary" engine was low, because of the friction of the piston slippers. Undoubtedly rollers would have been better in this case.

One of the most promising cam-track engines—potentially at least—was that produced in the Twenties by the Fairchild Aircraft Corporation of America. This had four radially disposed cylinders (or banks of four), the pistons of which were provided with rollers making contact with a large "figure-eight" cam, carefully designed to produce a true harmonic motion of two complete inward and outward strokes of each piston per revolution.

Connecting rods between the roller pivots of the pistons tied them together, on the principle of a rhombic parallelogram, so that one opposed pair, in moving outwards, caused the other pair to move inwards, and *vice versa*.

Side thrust eliminated

This mechanical system imposed no side thrust on the pistons, and loading on the cam and the rollers was relatively light if the contour of the former was properly designed. The engine could be made either static or rotary, with no basic alteration in design. Presumably it did not work out as expected, though it is difficult to understand why; at any rate, it never went into production, so far as I know.

A new cam-track engine brought to my notice a few weeks ago embodies some of the features already described, including the outward-mouthed cylinders and rotary valve of the "tangento-rotary" steam engine, and the "figure-eight" cam of the Fairchild-Caminez engine; though the latter surrounds the rotating system, and is internally contoured.

The new engine, for want of a better term, described as an "inside-out rotary," is the invention of Mr A. C. Mercer, of Bradford, who has built a six-cylinder working model of 1⅛ in. bore and stroke (111 c.c. total displacement).

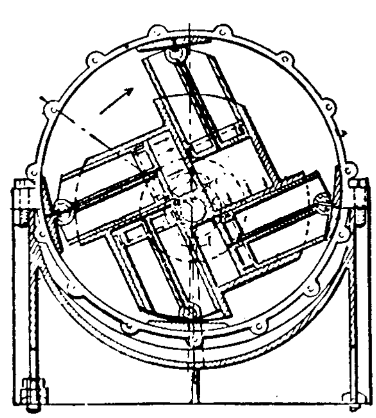
It works on the normal two-stroke principle, but as it cannot obtain crankcase compression, it is fed by a rotary blower, which is belt driven. In the centre of the assembly is a stationary hollow shaft, which forms the transfer passage, and has two ports diametrically opposite to control admission to the cylinder. The rotating assembly comprises a hexagonal hub, around which are equally spaced the six open-mouthed cylinders.

Each piston is fitted with a roller bearing which engages with the cam track, and as the system rotates, makes two complete inward and outward strokes per revolution. Contact is maintained by centrifugal force which pushes the pistons outwards so that it is not necessary to provide for positive operation both ways.

At the outward end of the stroke, exhaust ports, similar to those of an ordinary two-stroke, are uncovered by the piston. A sparking plug is fitted in the side of each cylinder, near the inner end, and the six plugs serve as their own h.t. distributor by coming in turn into close proximity to stationary conductors, to which current is supplied by two coils and contact-breakers.

The internal cam track may be defined as an undulating plane or "switchback," wrapped round the inside of a cylinder. When the rollers of the pistons are on the "downhill" parts of the track the pistons move outwards; on the "uphill" parts they move inwards.

As each comes to the inner end of its stroke, or the "top dead centre," the cylinder charge is ignited by the sparking plug, and the resulting combustion pressure forces the piston outwards. This produces a torque reaction on the assembly, which in turn acts as the propelling force. As the piston nears its outward position,



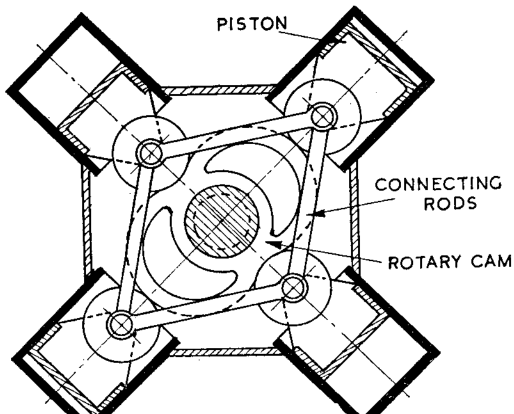
Tangento-rotary steam engine

the exhaust port is uncovered, allowing the products of combustion to escape, and very shortly afterwards, the ports of the rotary valve are opened to admit fresh mixture from the blower.

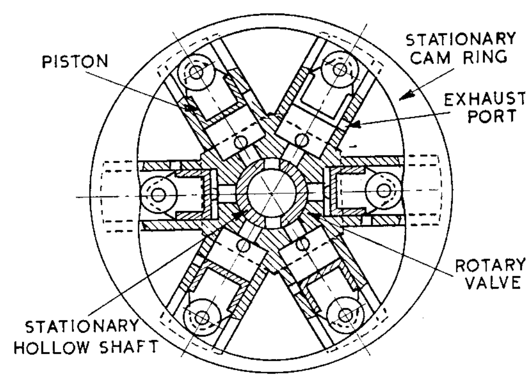
At 90 deg. from t.d.c., the piston is at the outer end of its stroke, and the next 90 deg. are occupied in pushing it back into the cylinder, thereby compressing the charge, which is then ignited, and the sequence of operations repeated.

Each cylinder, therefore, completes two working cycles per revolution, and the six-cylinder engine has an impulse frequency equivalent to that of ordinary two-strokes with 12 cylinders, or a four-stroke with 24 cylinders.

As the reciprocating parts of this engine are always working exactly in opposite directions at equal speeds, the balance can be made to all intents and purposes perfect. The working parts are few in number, and present no special machining or metallurgical problems.



The Fairchild-Caminez design



Principle of the Mercer engine

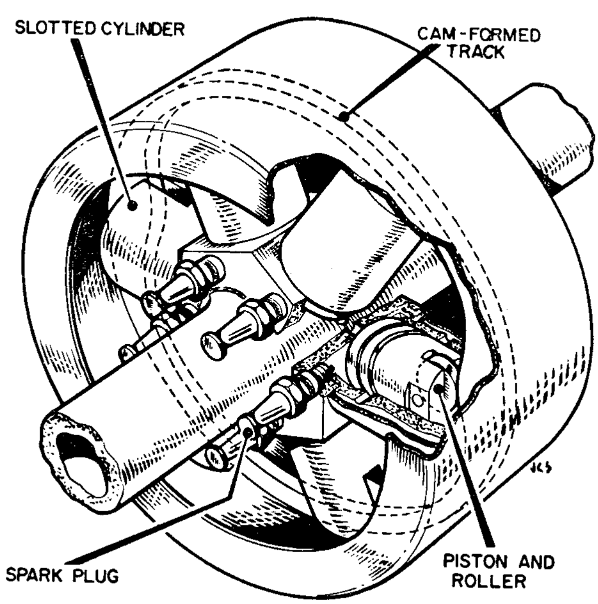
Cooling and lubrication are not difficult, but centrifugal force may be the limiting factor in the permissible speed of the engine, which has been restricted to 1,500 r.p.m. in the model illustrated.

It is said that plans are in hand for a further experimental version of the Mercer engine, a four-cylinder type for installation in a motorcycle. The principle is applicable to any number of cylinders, though with the cam form shown, the minimum number which will give good dynamic balance is two, and in this respect even numbers are desirable in any case.

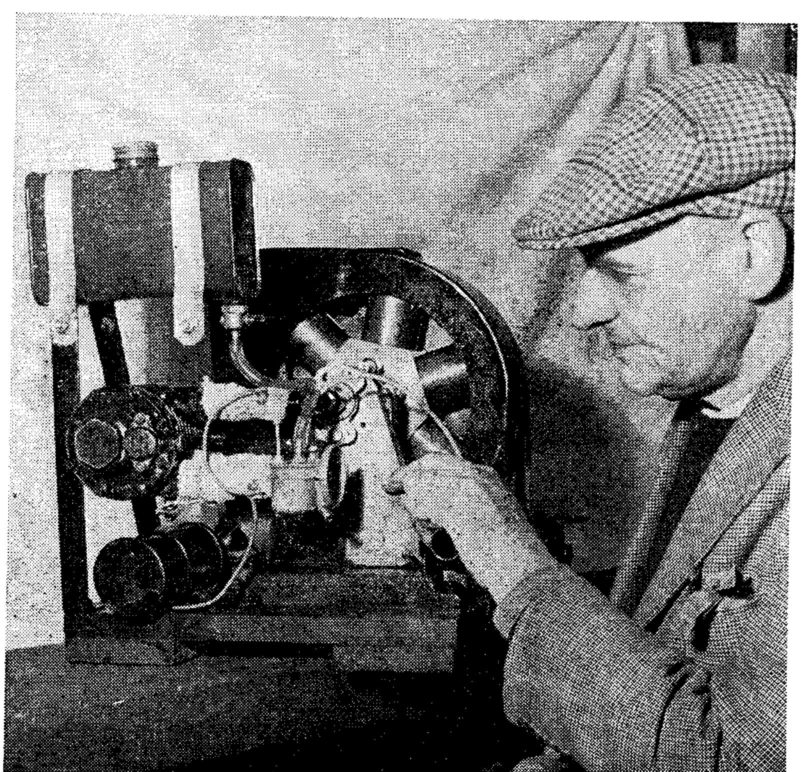
In a road vehicle of any kind, there is much to be said in favour of an engine which produces the maximum number of firing impulses for the minimum r.p.m. This offers possibilities of simplifying the transmission gear, and the old idea of building the engine into one of the wheels, first exploited by Singer at the beginning of the century, may be feasible with this kind of engine.

In comparing the relative virtues of cranks and cams for converting reciprocating to rotary motion, the major issues are mechanical efficiency and durability, but there are many other factors which influence the prospect of practical success, including convenience of application, ease of manufacture, and also of maintenance. Up to the present, most orthodox, and many unorthodox, engines still use cranks in some form or other, but one never knows what the future may bring.

There is no denying the ingenuity of the many engines which have forsaken the beaten tracks of standard practice. In common with many other model engineers, I always find them extremely interesting. They deserve attention not merely as mechanical curiosities, but also as examples of design which prove that there are still many regions in the world of engineering which remain to be explored by pioneers. ■



Artist's drawing showing operation of the Mercer engine


And here is the real thing

AROUND THE TRADE

In a new catalogue issued by the British Rawhide Belting Co. Ltd, of 246-8 Great Portland Street, London W1, and 15 Paradise Street, Liverpool 1, there is some very useful practical information on nylon and its uses in engineering, together with a list of rods, sheets and tubes of this material in a wide range of sizes. Bearing bushes in moulded nylon, also washers, screws, balls, rollers, stirring paddles, and slats for conveyor chains are also available from stock.

Holders for polishing

MANY polishing operations and light facing operations can be performed with simple equipment which is a substitute for something specialised or expensive.

A flat surface on work can be polished by holding it to a rotating disc which is dressed with fine abrasive. The face of the disc must be soft to contain the abrasive, but the backing should be firm so as not to deform. These conditions are met with a wood disc, faced with thin felt or flannel, stuck on with Bostik.

With the disc mounted in the chuck or screwed to the faceplate, the lathe should be run at a fast speed. It is advisable to cover bed and slides with paper or a sheet, although surplus drops of liquid metal polish, which is normally used, are flung off in line with the face of the disc.

For light grinding, a disc can be faced with emerycloth or emery-paper, which can be stuck to its face, like the felt or flannel for polishing. And

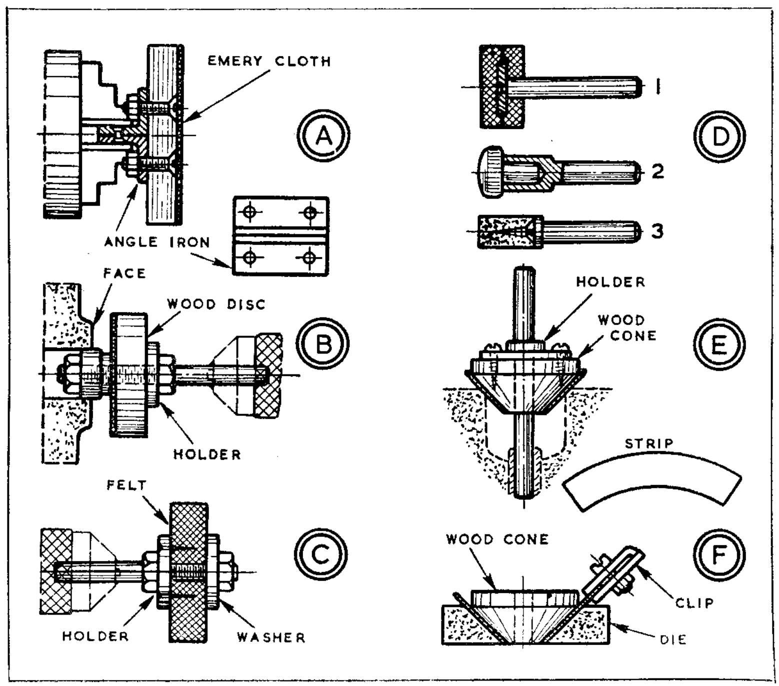
By GEOMETER

so, by using several discs, each with a finer grade of abrasive, you can begin a job as a grinding operation and end by polishing the work. Standardised holders enable discs to be changed quickly; a type for mounting in the independent chuck is as at *A*. Two pieces of angle iron are riveted together, and the disc is attached by four countersunk screws and nuts. The heads of the screws should be flush with the face of the disc, or the holes should be filled with plastic wood, to give a smooth surface.

To be certain that discs are flat, they should be trued with facing cuts before they are stuck on the emerycloth or felt; to keep these flat while the adhesive is drying, discs can be clamped or weighted to boards or other flat surfaces.

A light facing operation on metal can be performed with the tool shown at *B*. A wood disc carries a disc of emerycloth and is mounted on a holder so that it can be turned with a hand drill or electric drill. The operation is sometimes necessary on the body of an impeller water pump where the seal is made by a rubber cup and a carbon ring—the ring rubbing at the end of the body, which eventually becomes lightly scored. When that happens, a new seal is not fully effective—or not durable—unless the body is faced.

The holder consists of threaded rod, two nuts, a washer and a guide to locate in the pump body. The emerycloth should fully cover the face which is to be trued, and so the guide should be turned with a step, as shown. It



can be brass or duralumin. You can make the hole in the emerycloth with a punch of sharpened steel tube or by a piece of drilled rod—if you have no proper punch. The outside can be trimmed with old scissors after the emerycloth has been stuck to the wood disc.

A similar tool can be used to true and smooth a corroded seating face in the filler of a car radiator which is fitted with a pressurised cap.

Felt bobs can be made in a variety of sizes on the principle depicted at *C*. The holder can again be threaded rod and nuts, with a pair of large washers gripping the felt. The one on the shank of the holder should be drilled for four small nails to provide drive to the felt, all then being soldered together—shank, nut, washer and nails.

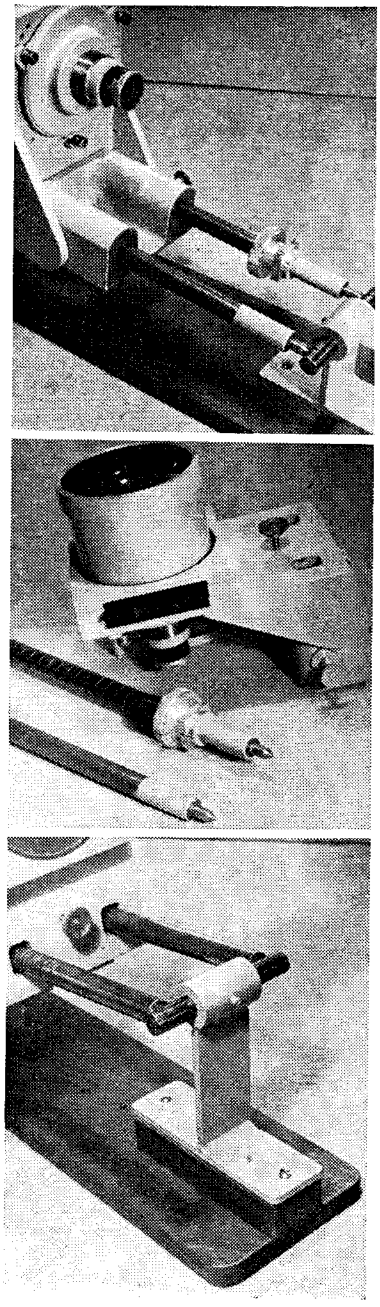
Diagram *D*1 shows how a small felt bob can be made with a washer riveted or brazed to a rod to form a shank, after which a felt disc and a felt washer are stuck one each side of this flange. With a long shank protected by rubber tubing, dirty shot gun berrels can be polished. A wood-faced lap can be made as at *D*2, and a small leather lap as at *D*3, a wood screw being soldered or brazed to a shank to take the leather.

Diagram *E* illustrates a tool for polishing a pitted valve seat, using a strip of emerycloth. This is curved, as at *F*, and is clipped and placed in a die for sticking to the cone. ◼

D. H. DOWNIE describes the further stages in the making of an enlarger

LENS MOUNT HAS TO BE ACCURATE

Concluded from April 12, page 457



Top: Lower bracket-bearing pin and hand control wheel. Centre: Opening in enlarger head for negative carrier twin columns with their lower-bearing 60 deg. points. Bottom: Upper bracket and bearing pin. The platform tilting screw is visible on the enlarger body

As the optical system of any enlarger is perhaps its most important part, it pays to be as accurate as possible in any work closely associated with the lens and condenser mounts.

To make the lens mount casting hold the small diameter set true, face, and leave a spigot 3/32 in. deep × 4½ in. dia. With a pointed tool, scribe a line on the lugs for the pitch circle of the bayonet slots.

Using the index collar on the cross slide, move the tool 65 thou each side of the line and scribe two more lines. These are an accurate guide to cutting and filing out the bayonet slots. Bore out the boss and screw to 10 t.p.i. Using lubricant, rough out the thread.

Hone the sides of the tool and finish to full depth with light cuts to give a clean, smooth thread. With the tool set at the last cut, recess away the first two threads. This will give you the correct diameter to turn the lens focusing tube for screwcutting. Reverse the casting in the chuck, face the small boss and clean up the exterior surface with light cuts.

Use any dissimilar metal, brass or steel, for the lens focusing tube. Bore out, leaving a ⅛ in. thickness wall in the bottom. This is to drill and tap later when you mount the lens.

Make the smaller bore in this a nice locating fit on the lens mount spigot. Cut the thread to fit the 10 t.p.i. in the lens mount casting. A good smooth hand fit is required here. Finishing with a hand chaser will give the best results.

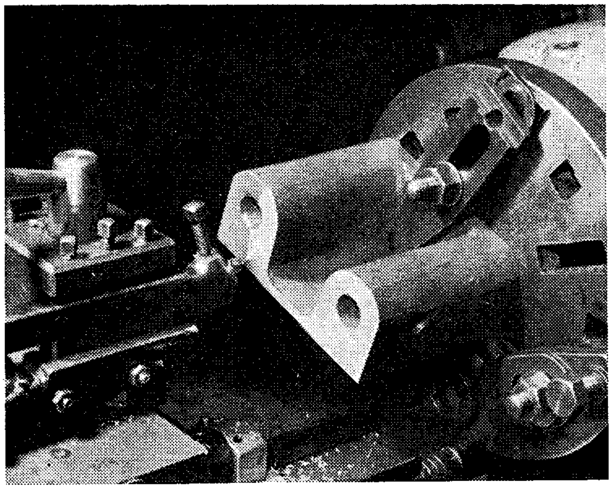
The two packing strips which make the negative carrier opening can be machined or filed up parallel and to equal thickness.

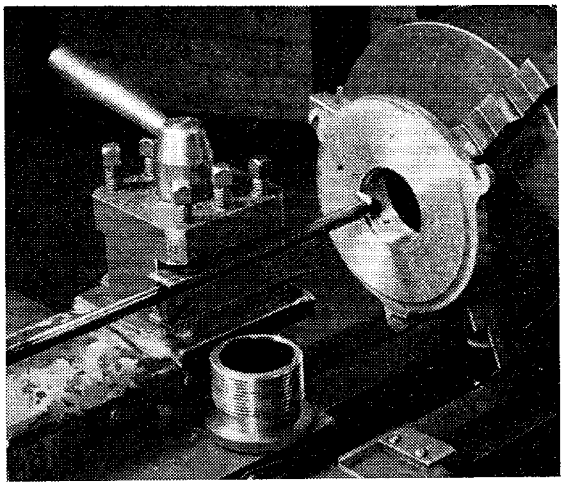
The wall brackets and support pins will require flat steel 2 in. × ¼ in. thick. Braze or weld the bosses on, drilling or boring them for the ⅝ in. dia. support pins. Use ⅝ in. dia. b.m.s. for the pins, bevelling the ends for good appearance. On the pins, set out the bearing holes accurately to 3½ in. with dividers, and centre dot.

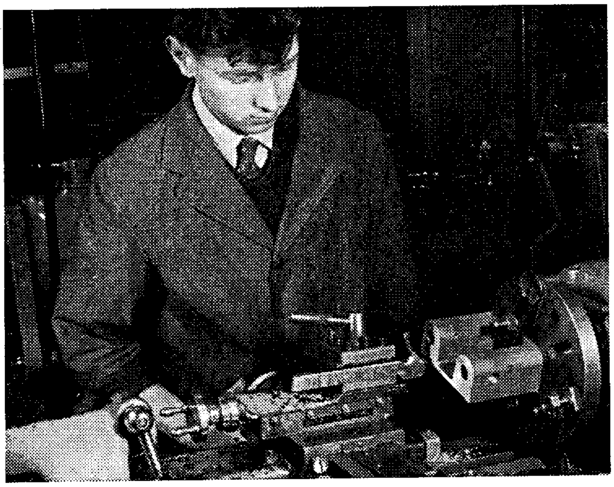
Drill each pair of holes in a pin at one setting in the vice, or hold the pin in a pair of V-blocks. To pick up your marking-off accurately, start each hole first with a centre drill. One pin has two ⅜ in. holes and the other two full-centre drill holes, to make bearing points for the two columns and allow them to float and revolve freely.

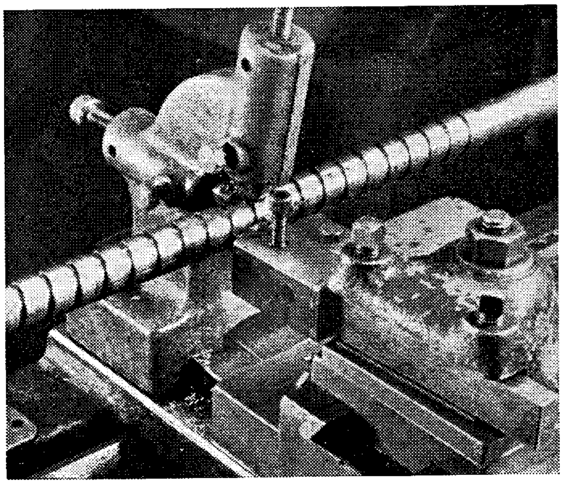
The lamp house is made from light-gauge steel sheet and two discs of steel plate, the lower one recessed to drop on to the diameter of the condenser tube. The top plate is bored through to take the boss which carries the tube and lamp holder. The plates are brazed to the top and bottom halves of the lamp house. You can use your own ideas here, if you are not handy at sheet metal working.

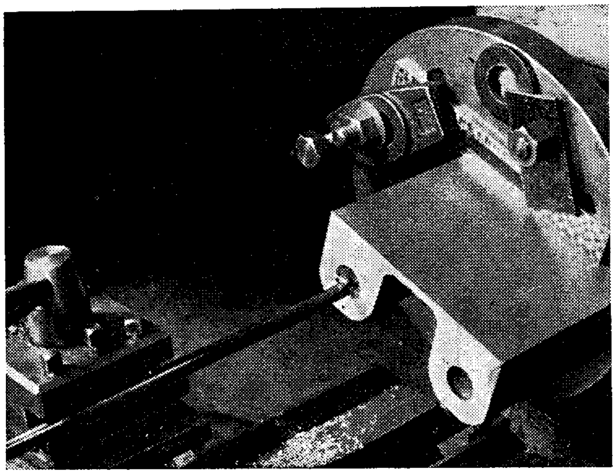
Completed lamp house

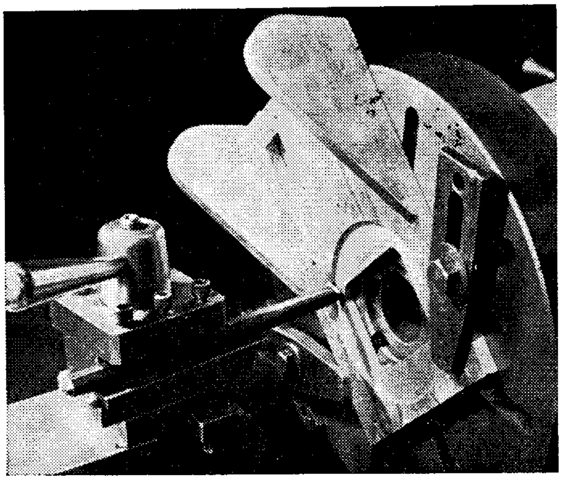












Sliding head casting—being machined in the top picture, finished off by a technician student in the centre, and bored to fit the columns at centres of 3½ in. in the picture immediately above

Top: Screwcutting the bayonet lens mount casting, with focusing tube to hand. Centre: Cutting 1½ in. pitch helix with travelling steady; a simple spring tool-holder makes for clean, easy work. Above: Tilting head platform; machining the recess for the spigot of interchangeable lens casting

Make a plain cylindrical shape, or look around the stores for a suitable tin container; it will serve just as well. Drill four holes in the top and bottom for ventilation, and cover them with small baffle plates. Use a brass lamp holder on the tube, as plastic ones may crack under the continual heat.

To assemble, hinge the tilting platform to the sliding head: use good solid brass butts. Sink the butts in the castings to make a good job. Locate and drill the holes in the platform to let the ⅜ in. rods pass through. Elongate these holes to allow the platform to rise and fall. Drill and tap for the tilting adjustment screw.

Mount the cover plate, packing strips beneath on the platform. Line up the sides of the two rectangular openings with a square and clamp together. Set out the holes for fixing and drill No 0 BA tapping size. Remove and open out the holes in the top plate and strips to clearance size, then countersink the four holes in top plate. Tap the platform holes, and you can then assemble. This arrangement makes the opening for the negative carriers.

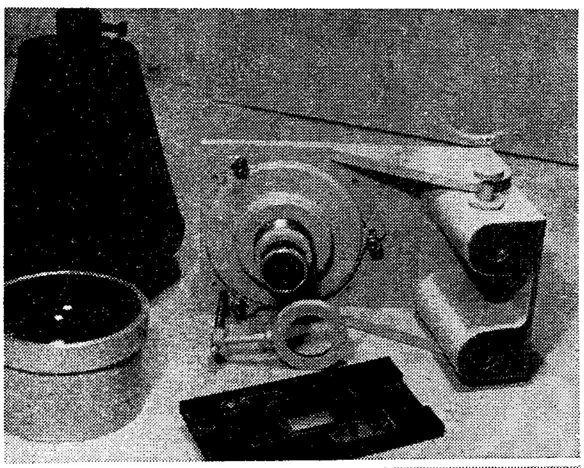
Drill and file out the bayonet slots in the lens mount casting to the lines scribed in the lathe. These will be at 120 deg. intervals. Locate the casting in its recess under the platform and mark out and drill the tapping holes for the BA studs. Use a taper tap; do not take it right through the holes, thus making sure that the studs will lock tightly into position when assembled.

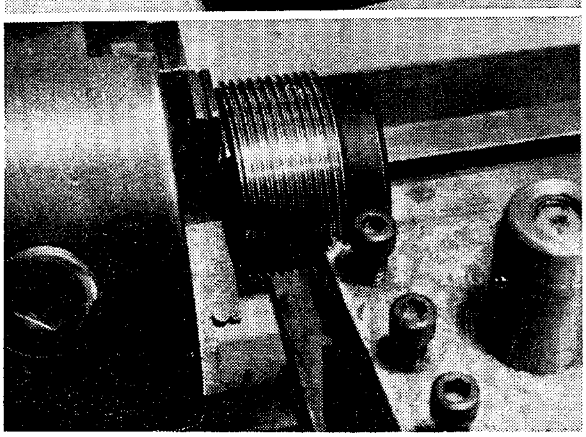
Make round knurled nuts for the studs. This arrangement enables you to remove the lens mount with a fraction of a turn, and change to a long focus lens for larger negatives if you wish to add one later. Drill and tap the hole for the filter mount clear of the lens mount casting. This is just an added refinement but is quite worth while. Smear a little petroleum jelly on the screwed focusing tube for smooth action.

Make the negative carriers from plywood or plastic sheet, two or three for different size negatives. Two cover glasses are required for each; your local glazier will cut them to size. The clamp pressure springs are made from short pieces of clock spring. Turn a hand control wheel 2½ in. dia. with knurled edge to fix to the lower end of the column which has the helix cut on it. Wood, plastic or alloy is suitable for this.

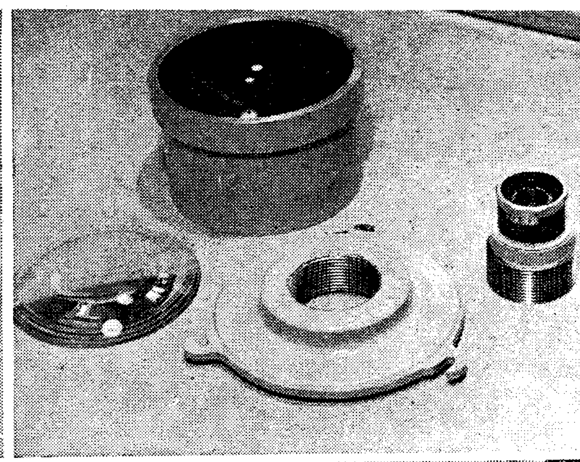
Finish all internal surfaces with Berlin Black to avoid internal reflections. The outside of the lamp house looks well in black crackle finish. The exterior of all the castings can be medium blue in eggshell finish.

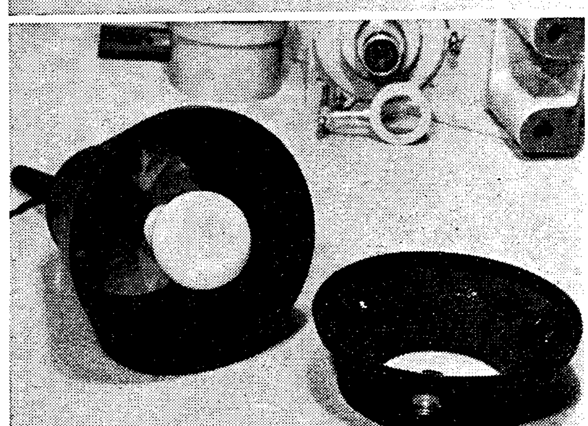
Mount the brackets on a 7 in. width of mahogany faced ⅝ in. or ½ in. plywood. Arrange the distance between the brackets so that the columns revolve freely with a positive minimum of end play. The pin with





Top: Parts ready to be assembled on the twin columns. Above: Here the 10 t.p.i. is being cut on focusing tube





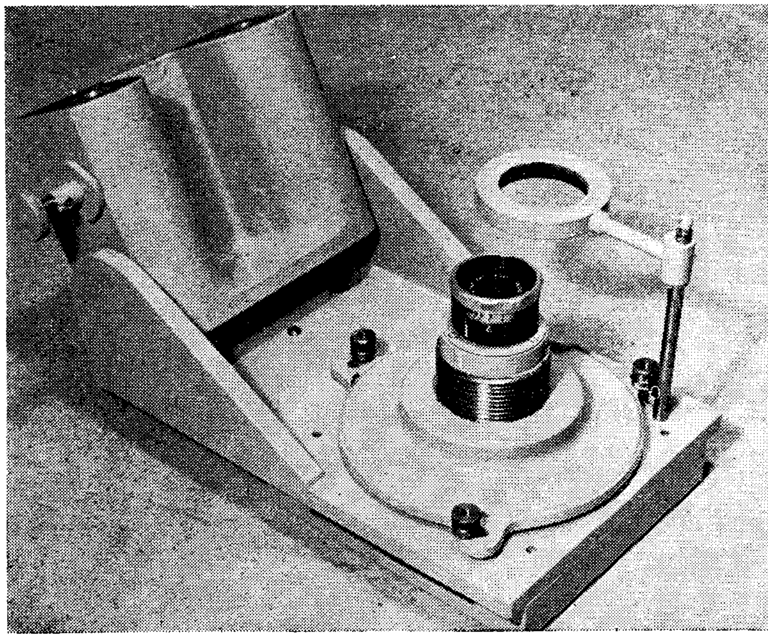
Top: Finished parts. Condenser tube with condensers; bayonet lanes casting; screwed focusing tube and lens. Above: Lamp house parts. "You can use your own ideas" the centre bearing holes will be at the lower end.

Stain and wax finish the mounting board. Fix the enlarger to the wall above the table on which you will work. With a spirit level adjust the tilting negative platform to the level of the table and you are all set for work.

For 35 mm. negatives you will need a lens of 2 in. focus; for 2¼ in. square or 3¼ in. × 2¼ in. a longer focus lens of 4¼ in. is needed. You can use the tilting table for correcting converging verticals in pictures which include high buildings.

After pushing the head of the enlarger up to its approximate position for the size of enlargement, engage the plunger and rotate your control wheel, moving the head up or down for the precise size and composition of your picture. ▣

● *The Looking Ahead issue published on April 12 included the first part of this article and also a six-page pull-out giving all the drawings for building the enlarger.*



FOR YOUR BOOKSHELF

D. A. Boreham's *Narrow Gauge Railway Modelling* (Percival Marshall, 21s.) is an authoritative and specialised work by the secretary of the Model Railway Club. It is intended for those who are already devoted to the construction of British narrow-gauge railway systems, but is so absorbing that beginners who read it will be keener on narrow-gauge than on standard, and the standard-gauge enthusiast (one of Mr Boreham's " miscreants " on page 24 ?) will want a narrow-gauge feeder somewhere along his main line.

The author makes a strong appeal for putting on record, in the form of accurate models, the little railways which have long since disappeared and those which have happily been preserved. He rules out completely the " high-speed main-line," such as the 3 ft 6 in. gauge railways of South Africa, and the metre gauge in Malaya, as they are not " true narrow gauge railways." But here, perhaps, overseas readers may not entirely agree.

As mixed-gauge is a peculiarity of some narrow gauge railways—especially on the Continent—Mr Boreham has dealt with its construction in detail. Examples of mixed-gauge junctions are clearly shown in the drawings and photographs. Special attention is given to wheel and compensated bogie design.

One chapter is mainly concerned with the practical construction of rolling stock, and another with metal work for coaches, underframes and couplers. On locomotive construction Mr Boreham provides a number of useful suggestions from his own experience in dealing with frames, crankpins, axles, bodywork, and the extra weights essential for adhesion.

The owner of a model narrow-gauge layout intending to give a demonstration at an exhibition or garden fete should note what the author says: " The first thing to remember about exhibition layouts is that the public pays to see them, so they *must* work. Furthermore, the public at large is not interested in the sort of activities which really make a model railway railway-like: station-work, shunting, timetable operation and similar activities. All the public wants to see are trains in motion, and the more the merrier." And so the owner and would-be exhibitor is warned.

Suggestions are made for the construction of the more unusual types of railways: the Irish Lartigue monorail, a rack railway, and a pier railway. We may like to add the name of the 33 in. gauge Ravenglass and Eskdale Railway, now running as a 15 in. line.

In one chapter, and in the bibliography, Mr Boreham offers help to the modeller in getting information on numerous narrow-gauge railways. For the lone hand this approach can be very irksome; he is strongly advised to join a club.

Useful advice is also given on the preparation of scale drawings of locomotives and rolling stock. Twenty plans of station layouts are appended, with seventeen full-page scale drawings of locomotives, coaches and wagons. They are fine examples of draughtsmanship.

The main emphasis of *Narrow Gauge Railway Modelling* is on the well-established 4 and 7 mm. scales, but there is, of course, plenty of scope for the modeller interested in 10 mm. scale layouts (the standard gauge is 45 mm). Thus, for a 2 ft narrow-gauge line the gauge would be 20 mm. and for a metre-gauge system the gauge would be precisely 32 mm.—gauge O.

Mr Boreham recommends the modeller " to use the largest scale he has room for." He also advocates scaling to the exact gauge. There is a variety of gauges below the 4 ft 8½ in., and so if narrow-gauge is to be made more popular some measure of standardisation may be advisable.

The book is entertaining throughout, is a good example of careful compilation, and is recommended for any railway modeller's bookshelf. E.A.S.

WHY NOT A WINDMILL?

To make a model of one, says PETER HAINING, is a form of preservation

Windmills, those tireless giants of an age that is past, are slowly disappearing from our countryside. If we cannot save them from being pulled down, we can preserve their memory by modelling them.

I recently visited a number of windmills in Norfolk—" The Windmill County." I have also studied windmills in Essex; but of the original 100-odd which were in existence 50 years ago, barely a dozen are still standing and in a reasonable state of preservation.

There are still plenty of windmills standing in Norfolk, which proves that the little groups of people who are working to save them are having a certain amount of success. A few are in fine fettle. Some have been bought by people and converted into comfortable homes. If only more people would do this!

Visit, if you can

Others, unfortunately, have been deserted and are now no more than rotting shells. Altogether, the number of windmills that can still be used for their original task of grinding grain must be very small.

I would urge any modeller who wishes to construct a miniature to study the original at first hand before beginning work; I do not think he can do a windmill justice by working from photographs.

Sometimes the whole mill is made to turn upon a strong vertical post; it is then called a " Post " mill. But more commonly (see diagram) only the roof or head (*a*) revolves, carrying with it the wind-wheel and its shaft, this weight being supported on friction rollers.

The sails or vanes (*b*) are attached by the frames to the extremities of the principal axis or windshaft (*c*), which is set nearly horizontal so that the sails revolve in a plane nearly vertical. In turn they give motion to the driving-wheel (*d*) which communicates motion to the shaft (*e*) and the machinery connected with it, which performs the grinding.

Because it is necessary for the windsails to be always facing into the wind, a large vane or weather cock is fixed on the opposite side to the sails, thus turning them continually in the right direction.

In large mills such as the one in the diagram, the motion is regulated by a small supplementary wind-wheel (*f*). Sails occupy the place of the vane and are at right angles to the principal wind-wheel.

When the windmill is in its proper position with the shaft parallel to the wind, the supplementary sails do not turn; but when the wind changes, they are immediately brought into action and, by turning a series of wheel work, they gradually bring the head round to face into the wind again.

Owing to the changeable nature of the wind, provision must be made for accommodating the resistance of the sails to the degree of force with which the wind blows. This is done by clothing and unclothing the sails—by covering with canvas or thin boards a greater or smaller part of the frame of the sails, according to the strength of the wind.

The two pictures of windmills, at Cley and Paston, Norfolk, are examples of tower mills. They were by far the most popular among millers and more of them survive. I feel sure that you have seen a tower mill.

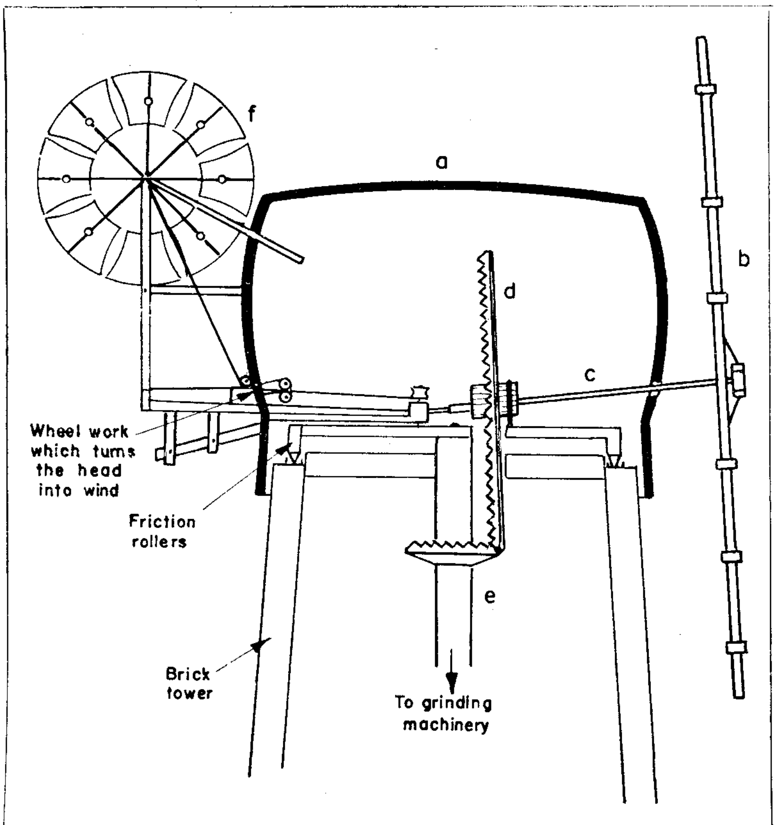
With a verandah

A smock mill looks rather similar to a tower. The basic difference is that the main body of the building is constructed of wooden planks laid on to the frame in the same way that tiles are put on a roof. The planks are nailed on parallel to the ground.

One windmill of this kind (at Upminster in Essex) has a verandah constructed around it about one-fifth of the way up the side of the superstructure.

Post mills are box-shaped and are pivoted, in the centre, on top of a massive wooden post which carries the whole weight of the structure. Probably the best example—still in a fine state of repair—is to be found at Aythorpe Roding in Essex.

Much can be learned about windmills by visiting the Bridewell Museum at Norwich which contains a section



Above: Cross-section of a windmill cap—Horsey Mill on the Norfolk Broads
Title picture: This is the mill at Cley-next-the-Sea, north-west of Holt

devoted to them. There are numerous pieces of equipment from old mills, many photographs, and a number of diagrams.

One picture shows the Catfield Windmill in Norfolk which was built for John Bygrave, a miller, by John Bower, millwright, in 1774. It is an early example of the post mill; in the following fifty years most of the windmills still standing in England were built.

The museum also contains the windshaft from the Thornham Windmill, which stood near Hunstanton. It turned on a blue marble block which was greased by hand while the sails turned.

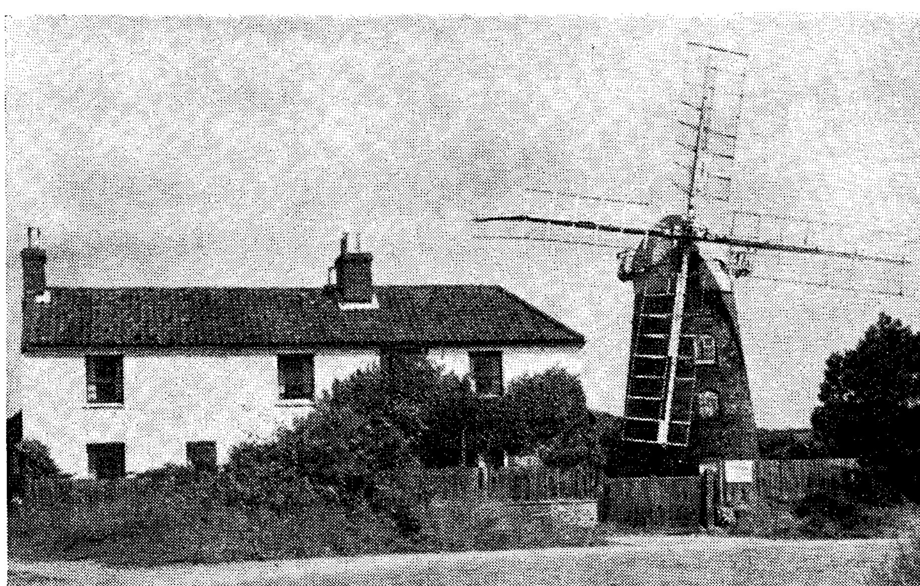
In most windmills oak was largely used for the wooden parts.

Withstood floods

The mill at Cley is probably the most interesting to visit. I was told that during the great East Coast floods in 1953 the water rose six feet up its side. Although it was battered by the angry waters, it was not damaged. The family living there were much better off than the villagers who had flood water almost up to the ceiling in their downstairs rooms.

The other mill shown, at Paston, is not in very good repair, but I am told that efforts are being made to preserve it.

In Norfolk the post mills at Sprowston and Forncett and the tower mills at Thurne, Weybruine and Horsey are well worth visiting. The only good smock mill of which I know is the one at Upminster in Essex. ▣



Here, for an age of purposeless clamour and rush, is a study in tranquillity—at Paston, Norfolk. The notice says "Teas"

BLUE LAMP TO STARBOARD

OLIVER SMITH writes of the river police who night and day patrol the street of ships that the Queen's Peace may be preserved

Most Londoners, and many visitors to the city, have seen the small, powerful Duty Boats of the Thames Police patrolling sections of the river.

The Thames Division of the Metropolitan Police originated from the efforts of John Harriott, of Great Stanbridge in Essex, Patrick Colquhoun of Dumbarton, and the great Jeremy Bentham, who in 1798 persuaded the West India Company to take properly organised action against the river pirates. Harriott selected his men one by one. They were tough characters, and many had served in the Navy. It was the age of Nelson; the Marine Force took shape in 1798, when Nelson found and destroyed Napoleon's fleet in Aboukir Bay.

In June of that year the first Police Office of the Force was opened in Wapping, where the Divisional Headquarters is today. At first the office had a judicial as well as a police department and was under the control of John Harriott as resident magistrate. It was a semi-official organisation, with the Government defraying the cost of the magistrate, clerk and constables and the West India Merchants supplying some of the water police and watchmen.

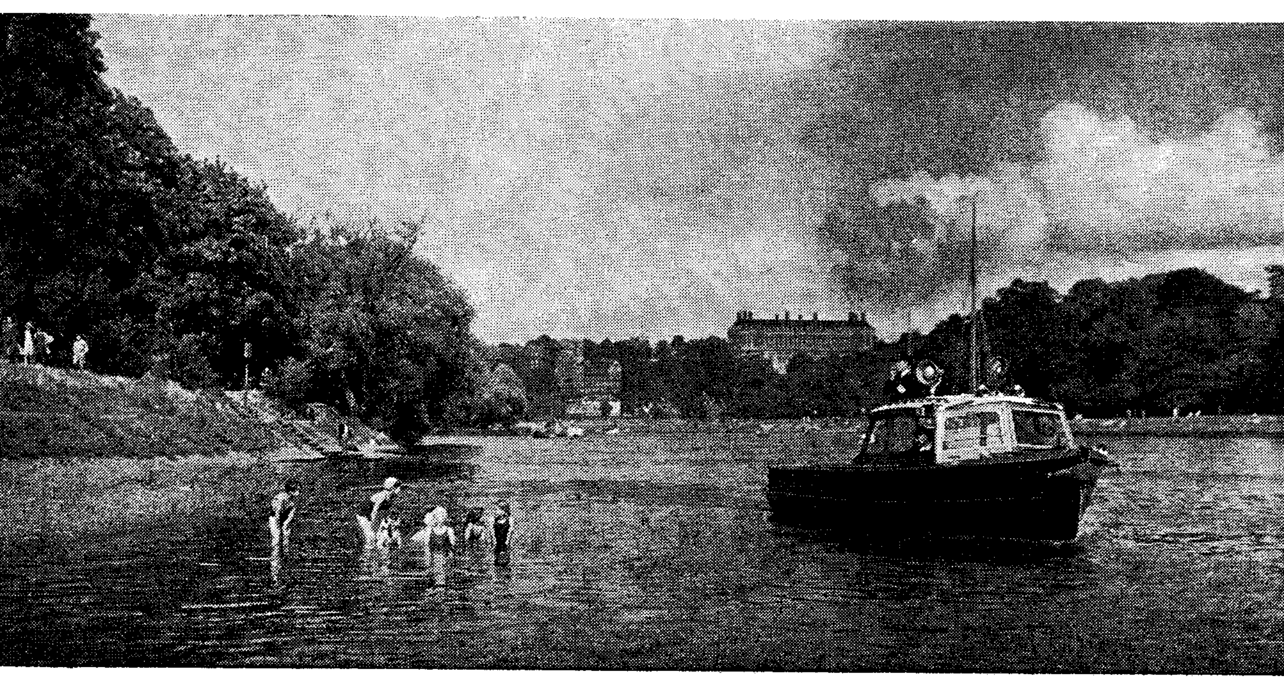
Many of those in the Thames Division of today are men who have been in the Royal Navy or the Merchant Navy, but this kind of service is not an essential qualification. The personnel, all volunteers drawn from the many Divisions in the Metropolitan area, must be able to swim and to pass an examination in the management of boats and in navigation before they are accepted.

The old Marine Police Force lasted until 1839. It was incorporated into the Metropolitan Police as the Thames Division, and the judicial part became the Thames Police Court.

As the pattern of the trade on the Thames changed over the years, so the Police Force had to modernise its equipment and administration to provide all who used the river, both afloat and on its shores, with an efficient service. The hardy band of mariners who rowed out, armed with cutlasses, to protect the merchandise of a private company, has grown into a force which has a fleet of power boats patrolling thirty-six miles of river, and carrying more devices for saving life than for maiming it.

Power boats were first introduced in 1910, and today the Thames Division has a fleet of thirty-one duty boats and three police launches. The duty boats are built mainly from wood—teak, mahogany or a combination of both—and are 30 ft long with a beam of 8 ft 6 in. and a draught of 2 ft 6 in. Power provided by a Perkins P6 diesel engine rated at 85 b.h.p. gives the craft a speed of about 10 knots. The cooling water system of the engine is operated on the closed-circuit principle, with the hot water from the engine travelling along cooling pipes fitted in the keel. The gearbox is oil-operated and self-changing.

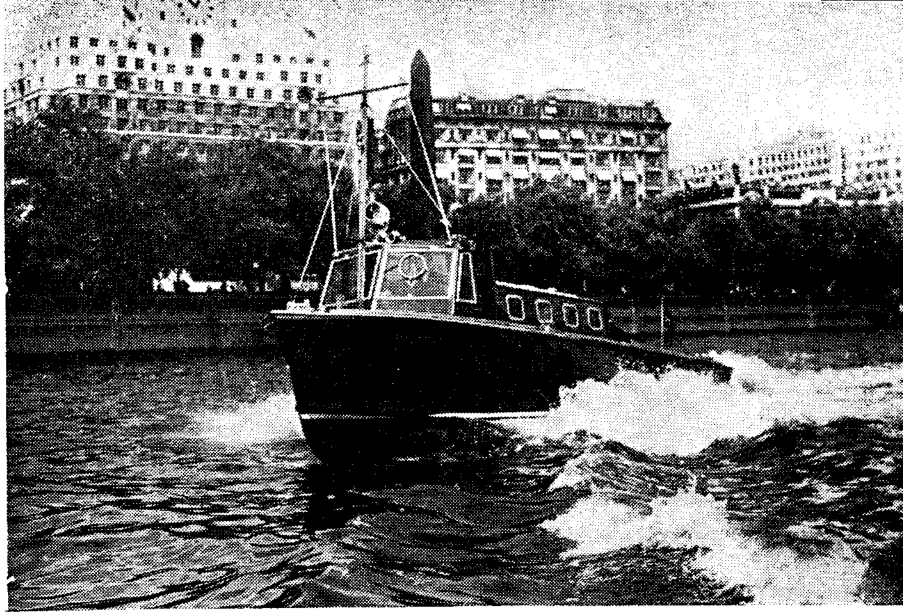
For ceremonial or supervisory duties



the Chief Superintendent or Superintendent uses one of the three launches. These are converted RAF Air Sea rescue launches with a cruising speed of about 20 knots. Each of the twin propellers is driven through an oil-operated self-change gearbox by two Perkins S6 diesel engines rated at 100 b.h.p. The cooling system works on the same principle as the one adopted for the duty boats.

Unlike the duty boats, each of the three launches bears the name of one of the pioneers of the police force. Two I have already mentioned, Patrick Colquhoun and John Harriott; the third is the founder of the London "Bobbies," Sir Robert Peel.

The launches have a length of 40 ft, a beam of 9 ft 6 in., and a draught of 2 ft 9 in. Each craft weighs from six to seven tons compared with the three and a half to four tons of the duty boats.

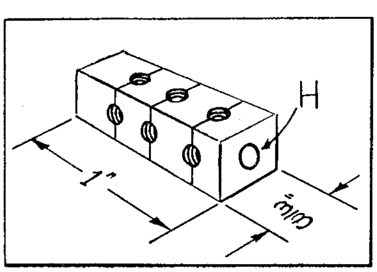


All the craft carry equipment to handle most of the emergencies with which they may be confronted. It includes such things as drags, lifebuoys, buoyant cushions, salvage gear and first-aid equipment, with a stretcher and resuscitator. The boats have two-way radio telephony and are in constant touch with Scotland Yard, and with patrol cars.

The system of patrols is similar in principle to the beats on land. There are five sections in the area from Teddington in the West to Dartford Creek on the South shore and the River Beam (Fords Works) on the north shore in the East.

All but one of the five police stations are now on shore. Originally they were accommodated on old hulks, but now the station on Waterloo Pier can claim to be the only police station afloat in Britain, if not in the world. ▣

MAKING TINY GRUBSCREWS



The chief difficulty in making small grubscrews is in handling them for finishing operations after parting. The little block in the drawing eliminates the worst bothers.

Having chamfered the end of the rod and threaded it with the tailstock die, take a parting cut so as to leave a screw of the length required. The piece is not parted right off; it is left attached to the parent metal by a stem, about 1/32 in. in diameter. Then, by hand pulling the lathe belt, the embryo grubscrew is threaded into one of the corresponding holes in the jig block, where, on reaching bottom, the stem shears off, leaving the screw blank firmly held.

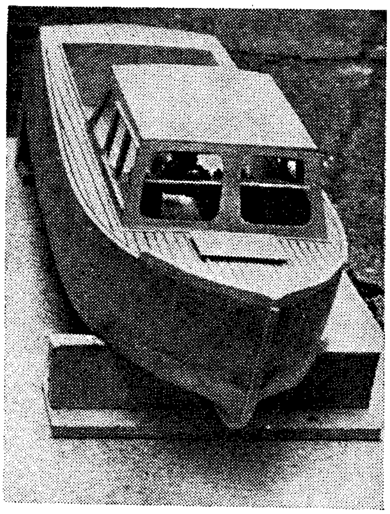
If the block has 12 threaded holes, all may be filled quickly. Then the jig may be held in the bench vice, so that the screw heads can be trimmed with a file and the screwdriver slots cut with an Eclipse Junior saw.

In building my derrick crane I needed about six dozen 5/32 in. Whit. × 1/8 in. grubscrews. I made the jig from 3/8 in. square bright steel.

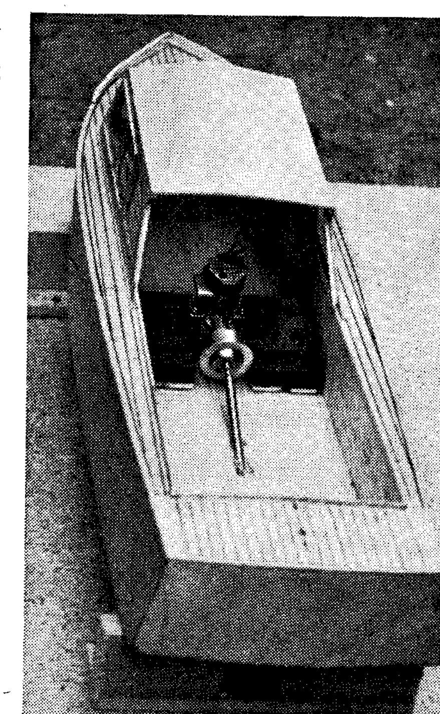
Chuck the work in the four-jaw, face each end, centre drill, and drill through 5/32 in. at *H*. Mark six hole-positions as indicated, drill right through, and tap 5/32 in. Whit. On plugging the hole *H* with 5/53 in. plain rod, you will have left in the block 12 fully-threaded blind holes to receive the grubscrews. The scribed lines may be left as a guide for head sawing.

MARTIN CLEEVE.

Anyone can build this DUTY BOAT



After writing about the little ships of Scotland Yard, OLIVER SMITH introduces a kit for the beginner who wants a model

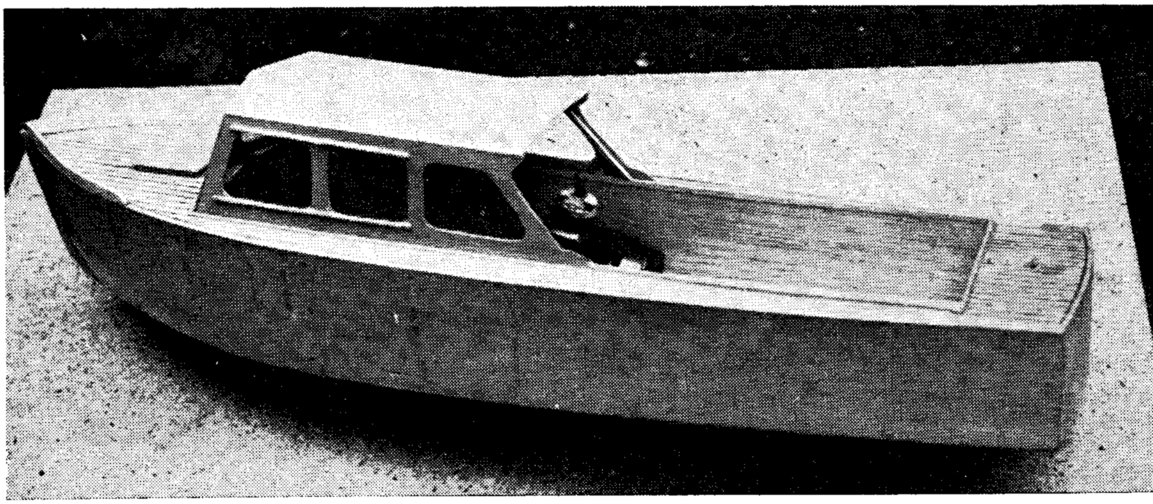


AFTER reading of the London River Police, some readers may want to build a working model of one of the Duty Boats.

The constructor with plenty of experience of model power boats will have his own ideas and methods and can safely be left to forage for himself. But what about the man who lacks this confidence? Usually he has so strongly convinced himself that model boat building is beyond his capabilities that it is difficult to prove him wrong.

In the workshop of MODEL ENGINEER much experimental work is carried out in devising ways of helping readers who make everything from the bare material. To the raw beginner, who has to be shown every detail, we offer simple advice, so that he can progress in easy stages and gain experience. For the power boat enthusiast we would probably recommend one of the better-class kits. While the " experts " frown, kits have many distinct advantages for the beginner and serve as a good introduction to the serious side of modelling.

All the material is supplied to complete the model and some of the more difficult parts are already shaped. The kits are ideal kitchen



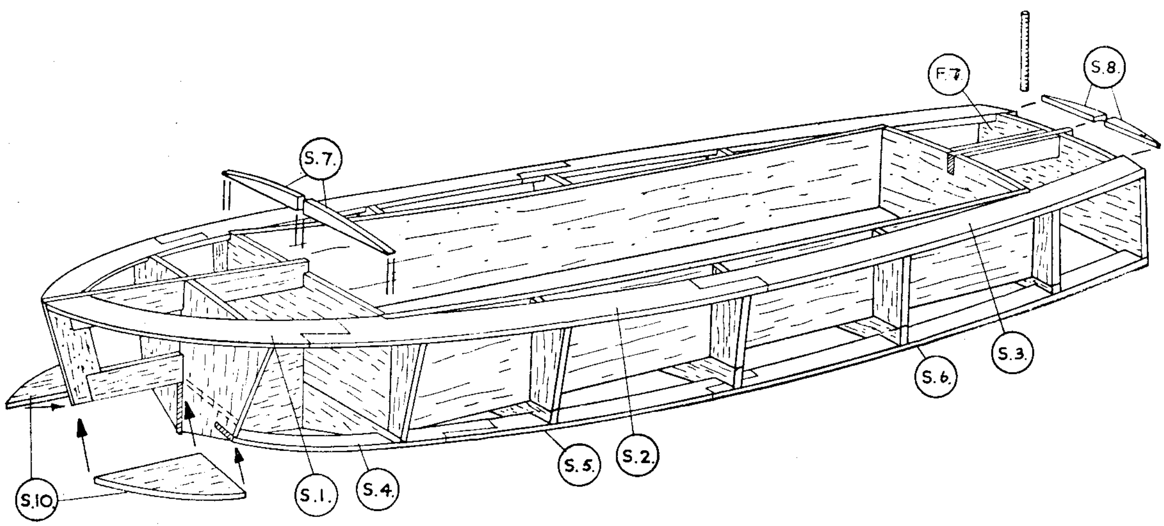


table projects; they do not need an elaborately equipped workshop and they can be finished in a fairly quick time.

It gives the beginner a great moral boost to make something with his own hands. After this all-important hurdle has been crossed, he will never be satisfied with his efforts, and with each future project he will try to improve.

If he would like to build a working model of one of the River Police Duty Boats he cannot do better than buy a Veron Kit manufactured by Model Aircraft (Bournemouth) Limited. One of these kits was recently sent to the ME Workshop for review, and to gain an unbiased view of its capabilities we had it assembled by a beginner. The photographs on this page show the results of his effort.

The design centres in a rectangular box and the actual shape of the boat is obtained by formers fixed at set intervals. Most of the parts are cut to length and shapes like the formers, and the stringers are pre-cut in balsa sheet.

Everything went together very well —but you should guard against taking everything for granted. This is very easily done when everything is neatly shaped and clearly marked. Check every item and see it fits properly before you finally apply the glue.

A very good drawing included in the kit makes the assembling easy. There is also a list of instructions, offering points of guidance. It is difficult to see how anyone could ever make a mistake.

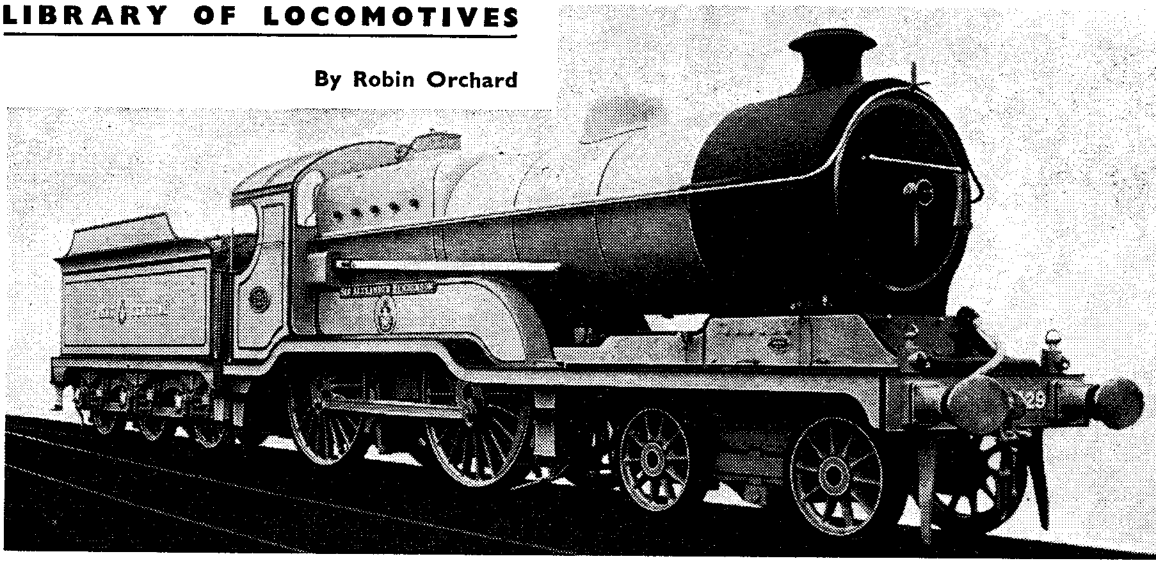
The main material used in the construction is balsa. We used Britfix 99 balsa cement for the securing of all balsa parts. The outer covering of the hull and the deck is in 1 mm. ply, and for fixing it to the framework we used Cascamite.

When the hull had been completed, and before the cabin was put into place, the power plant was fitted. The choice of power plant is left to the constructor. It can be either an electric motor or one of the small diesel engines. There is ample information on the instruction leaflet, which gives recommended sizes of motor and suitable sizes of propeller.

We fitted an ED Bee 1 c.c. diesel engine to drive a two-bladed propeller —the stern tube, propeller and propeller shaft are supplied separately by the makers of the kit. The complete unit went together very easily and made a very suitable power plant for the craft.

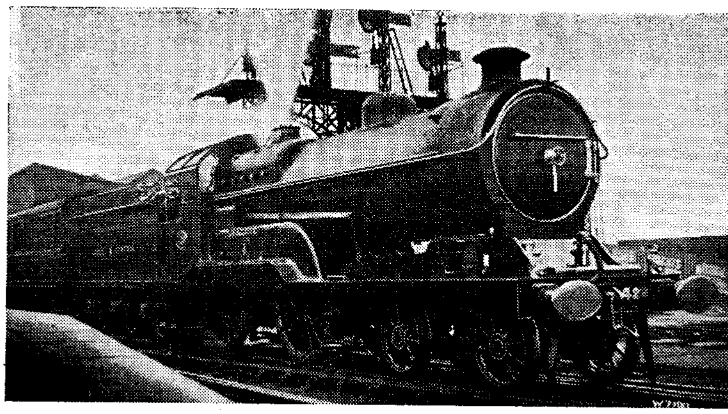
● *Continued on page 532*

By Robin Orchard



First Director—without valance covers over the coupling-rod throws. [*British Railways picture*]

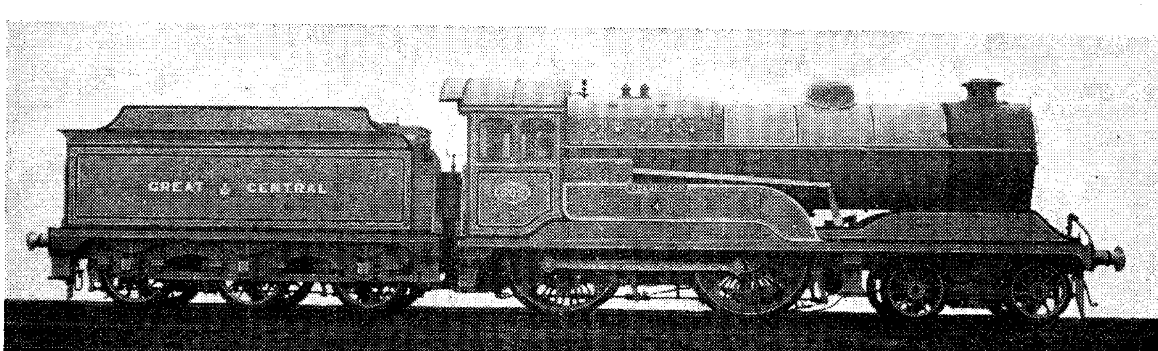
Continued from March 29, page 401



No 429 SIR ALEXANDER HENDERSON, *renamed* PRINCE HENRY *in* 1920. [*Real Photos Limited, Southport*]

LONDON TO LEICESTER:

103 miles in 114 minutes

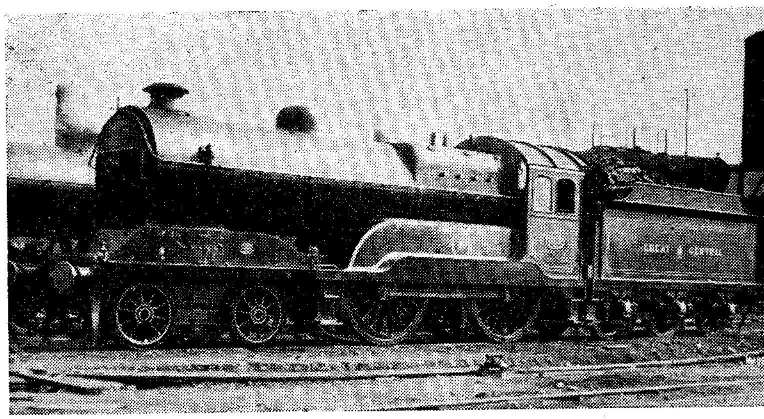


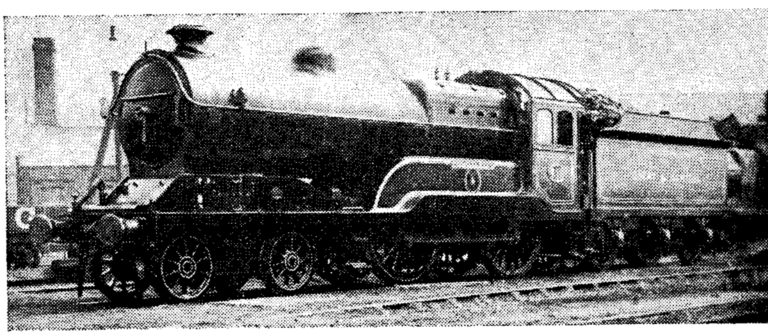
Improved Director: No 502 ZEEBRUGGE, *one of the engines called after battles of the* 1914 *War* [*BR*]

While I was preparing these articles on the Director 4-4-0s, I wrote to British Railways for a photograph of the original engine, 429 *Sir Alexander Henderson*, as she was when first built. I was rather surprised by the illustration I received, for it showed the engine without valancing over the coupling rod throws.

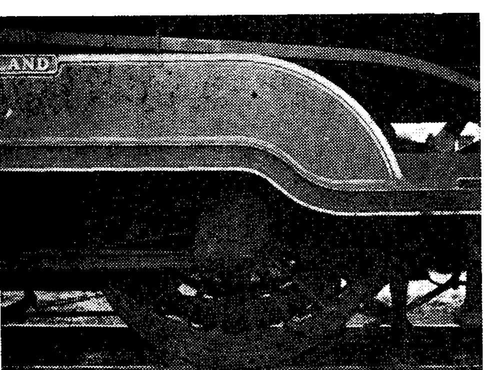
This was very puzzling, for I had always believed that the engines had the valances throughout the pre-group period, and that it was not until LNER days that they lost it. Yet, here was a photograph which proved me wrong. I checked through my photographs of the class, and all showed the engines with the covers. Perhaps the valances were cut away later, in pre-group days ? I was just beginning to convince myself that this was so, when a friend showed me a picture of the engine after its name had been changed in 1920. It still had valances. . . .

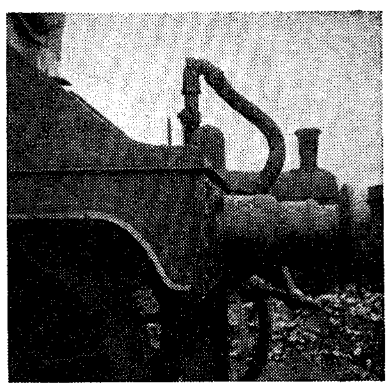
Only one theory was left, that the

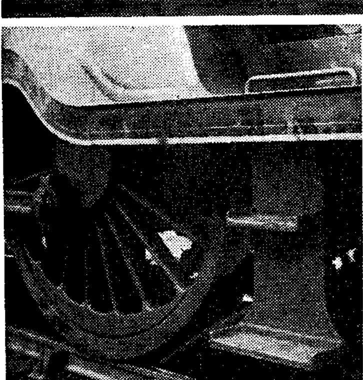




Here are two more Improved Directors —Nos 508 PRINCE OF WALES (*top*) *and* 510 PRINCESS MARY. [*Both Real Photos*]







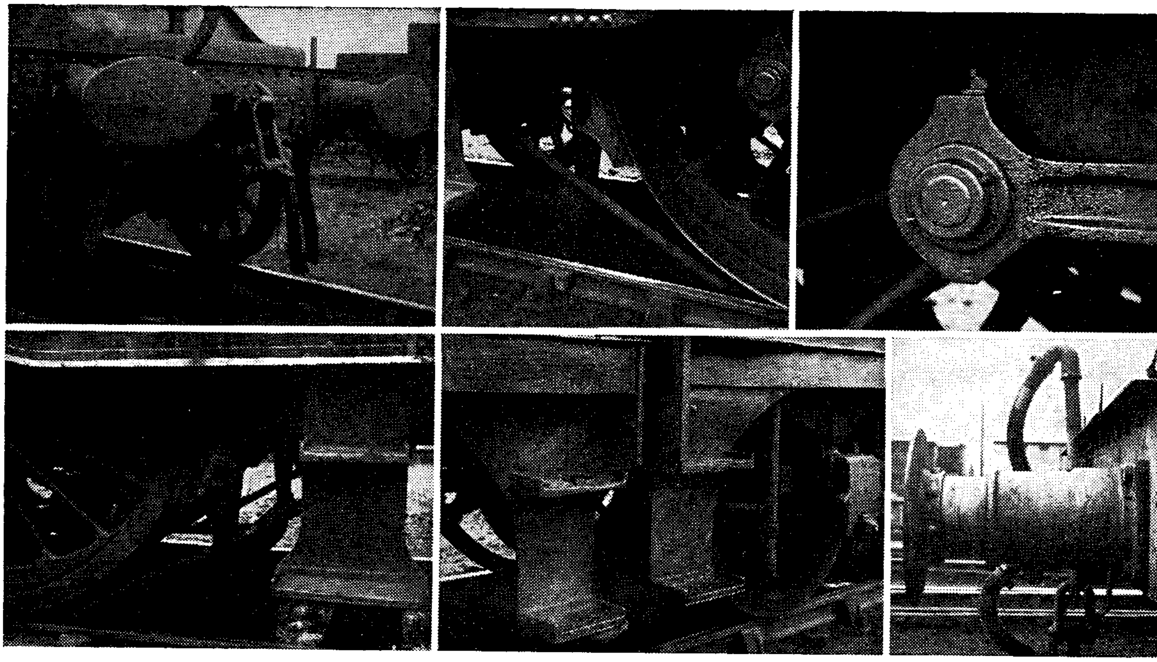
engines had been originally built *without* the covers and Robinson had decided that they would look better *with* them when they entered service.

Two of the engines were re-named. No 429 *Sir Alexander Henderson* became *Prince Henry* and 437 *Charles Stuart-Worsley* became *Prince George*.

Robinson was extremely pleased with his original Directors, and in 1919 he introduced a further series which were virtually the same as the earlier engines. A few minor alterations had been made to improve them and bring them up to date. I think it is pretty obvious that these engines would have been built earlier, probably in 1915, but for the shortage of materials in the First World War.

The only visible alterations were the substitution of Ross pop safety valves for the Ramsbottom device, the provision of a much larger cab with sliding windows in the side, an extension of the roof over the join between tender and engine, and a re-designed top to the framing at the front end. Undoubtedly, the cab was one of the most elegant ever seen in Britain. What is more, it blended into the fine lines of these engines perfectly.

Out of sight, a few more alterations had been made. The boiler layout was slightly different and the bogie



These detail photographs by Brian Western show the D11 *class locomotives in their final form*

was able to negotiate sharper curves.

Eleven engines formed the class. It was the original intention to name them all after directors of the company but in fact only the first two were so named. These were 506 *Butler-Henderson* and 507 *Gerald Powys Dewhurst.*

The next three were all named after Royalty, and I think, it was at this time that the two original engines, 429 and 437, were renamed. The new engines were 508 *Prince of Wales,* 509 *Prince Albert* and 510 *Princess Mary.* The final six of the class were all named after famous World War I battles, 501 becoming *Mons,* 502 *Zeebrugge,* 503 *Jutland,* 504 *Ypres* and 505 *Marne.*

Were the new engines up to the standard of the earlier ones ? The record of a run by 510 *Princess Mary,* on a very heavily laden Marylebone-Manchester express in 1921, should answer the question.

Steadily No 510 climbed out of London. By Neasden, despite the difficult first $2\frac{3}{4}$ miles, she was travelling at 57 m.p.h. Out towards Harrow she headed, keeping the speed up to 40 over the long lengths of 1 in 100. Once the initial drag was over, she really began to get the bit between her teeth, and by Pinner she was up to 59.

Slowly the speed dropped back to 50 as she battled up to Northwood. Over the top and down Sandy Lodge she came, the driver holding her back to 62 because of the sharp slack at Rickmansworth—an unfortunate slack, for it made the climb up to Amersham that much harder. Still our Princess was not worried; she dug her heels in, and crested the rise, still doing 32. She had clocked 11 minutes 20 seconds for the 6.4 miles from Rickmansworth to Amersham.

The driver now let her have her head, and down the Missenden dip she flew, sending the speed into the seventies. Up the bank she forged, to break on to the downhill of Wendover still travelling at 48, and down the bank she raced, with the speed flashing up to 80.

With such a heavy train the averages from Marylebone were very good At Amersham it was 42. Slowly it crept up—43 by Missenden and $48\frac{1}{2}$ at Wendover, easing slightly to 45 at Aylesbury, and then back to 48 for Quainton Road, Glendon Junction and Calvert.

Up the three miles of 1 in 176 known as Finmere Bank, the Princess slogged, keeping the speed above 43. She went over the top and down the other side at 60, and then up the 1 in 176 of Brackley Bank. This time she managed to keep above 45.

The average had increased to 50 by Finmere, but the banks brought it back to 43 by Brackley. By Hemerdon it was 49. It was 50 by Culworth Junction and 51 by Woodford. There were now only $33\frac{1}{2}$ minutes in which *Princess Mary* had to cover 43 miles to Leicester. This meant an average of 61 m.p.h. Could she do it ?

As she battled up to Charwelton she began to slow: 57 . . . 56 . . . 55. . . . And then she was over the top and heading for Braunston. Up and up went her speed, until it reached 80 and stayed there. Even Rugby could slow her only to 64, and by Sharwell she was back to 72. She sped up the Lutterworth banks, and did not allow her speed to drop below 54, so that when she reached the downhill run to Ashby she was quickly back to 80. Leicester loomed up; and 114 minutes after leaving Marylebone, 103 miles away, *Princess Mary* stood in Leicester, two minutes early.

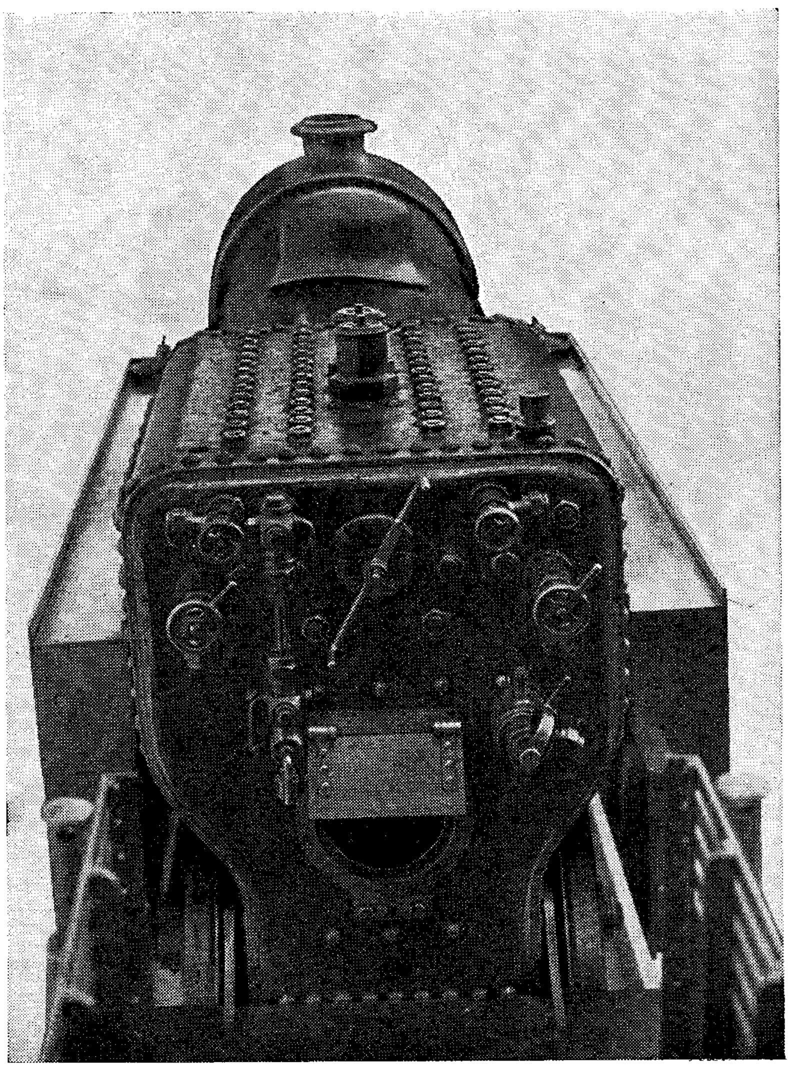
★ *To be continued on May* 10

PRINCESS AMELIA OF THE GREAT EASTERN

Putting on the backhead

J. F. BANYARD reaches one of the most interesting stages of model locomotive construction—the inside of the cab

Continued from 29 March, pages 405 to 407



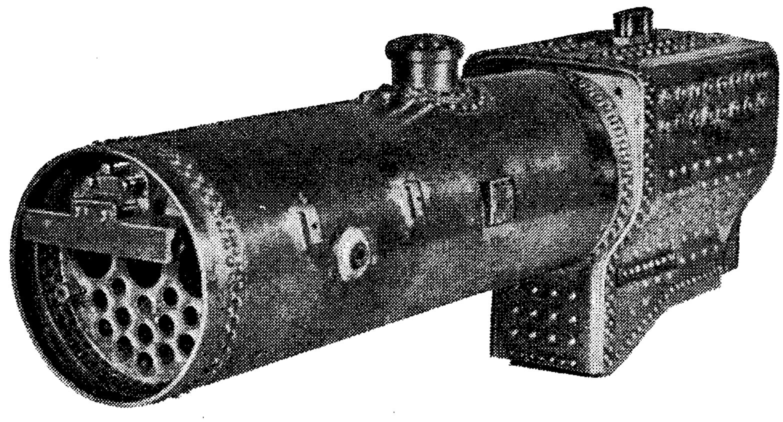
BEFORE placing the inside firebox and tubes in the barrel, I riveted in the front tube plate, I had finished boring for the steam pipe and drilling the stay holes and the holes for bolting the superheater header.

Having got the inside firebox and tubes in by clamping suitable pieces of plate in the foundation ring position, I gently set the top crown stays under the outside wrapper, ready for drilling the rivet holes. There are four lines of these for the four flanges on the outside crown stays. The centre one, is only $\frac{1}{2}$ in. or so high, as you must clear your regulator rod.

I then drilled the holes through these flanges, cleared off the burrs, and put in a number of temporary bolts. It was my intention to rivet these stays to the Belpaire outer wrapper, but on doing a few of them I found that the outside plate was being distorted although I could find no apparent cause, unless it was over-vigorous riveting of the snap heads; and so I drilled out the few rivets, opened the holes out to No 30 drill, and made 5 BA phosphor-bronze bolts. On the outside wrapper I have tinned and riveted a thick pad of copper in the centre, and drilled and tapped $\frac{3}{8}$ in. × 26 t for safety valve holes. You can see the rows of bolt heads in the photograph of the backhead fittings.

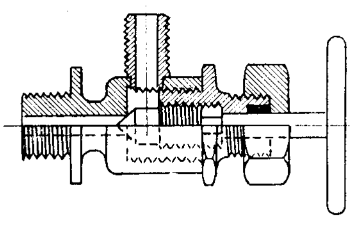
Copper bar was sawn to fit in the front and sides of the foundation ring. I wanted the firehole door used by a number of railways, including the Great Eastern, which employed it in my time on all the Clauds. I took a circular piece of steel, which could be machined all over thick enough to be drilled through for metal surrounding the rivet hole and made as wide as the waterway between the inside and outside ends of the fireboxes. By making it ⅜ in. on my engine, I could slide a hefty piece of 2 in. wide × ⅜ in. thick b.m.s. flat. With various ¼ in. holes drilled in the top end of this, I could put in ¼ in. dia. snaphead rivet dollies, I was able to rivet even the backhead in position. Before doing this I had other things to engage me.

All stays were 5/32 in. × 40 t and were drilled first only on the throatplate and backhead and for all the holes for backhead fittings. On the longitudinal stays the 5/32 in. × 40 t was tapped and nutted on the outside of the backhead and the tension nipples at the smokebox end, so as to keep the backhead neat. I used 5 BA brass nuts tapped out 5/32 in. × 40 t. This was the size nuts on all stays except, of course, the ones for the front tube plate.



Now we have to wangle. For the two rows of cross stays, as in the drawing, I screwed 5/32 in. copper rod, with good cutting oil, and cut a little longer than the finished nutted stay when it was in position. These rods are screwed about an inch of thread each end. A number of 1/32 in. thick copper washers, with a 5/32 in. hole, and painted with Fry's HT paste, was tinned ready.

For the assembly in the firebox, one hole was drilled tapping size and then tapped, and the opposite hole was drilled plain 5/32 in. dia. Each stay was fitted with alternate plain and tapped holes for the two rows. I inserted the stay through the plain hole, and before it entered the opposite tapped hole I threaded on a nut and the tinned copper washer. When the part had been screwed into the tapped hole, there was room on the other side for me to thread the nut and washers and screw back the stay until I had enough for the outside nut.



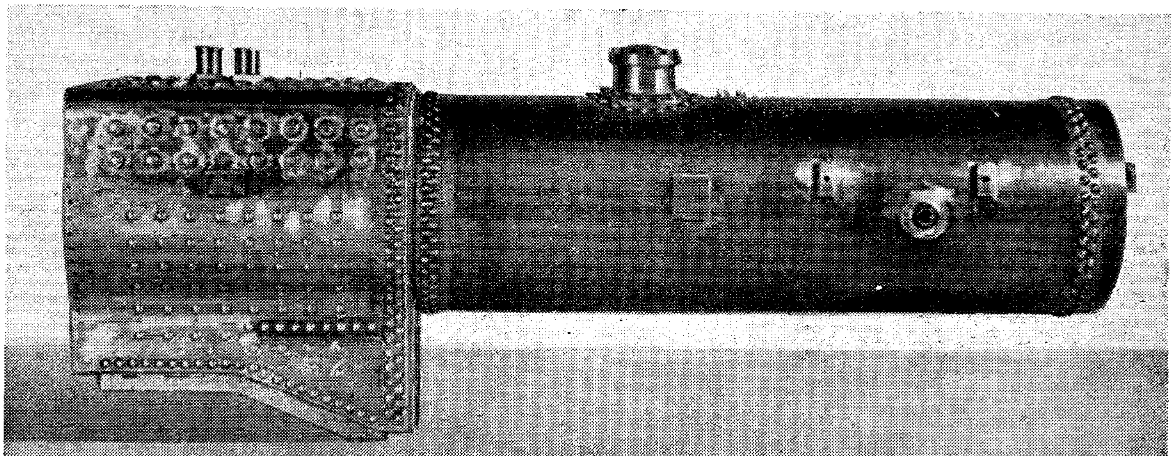
Then, with another of our old friend's tools, the long slim piece of, say, ¼ in. × ⅛ in. strip of b.m.s., with a swivel short-jaw riveted on the end, I could turn the inside nuts back until I felt a gentle pressure on the wrapper plate each side and tighten up outside nuts. The farthest stay was put in first.

I kept the same feeling of pressure on all the cross stays and left them like that for the time being. The backhead was then clamped in position with a ⅜ in. thick of 2 in. wide b.m.s. flat to keep the backhead square clamped while drilling the holes in the flange for rivets.

The circle of holes in the backhead was drilled for holding the firehole door ring, then used as a template to drill the copper ring itself, leaving only the inside firebox plate to be drilled in position after the backhead was riveted on. The backhead has only one row of rivets, as it was impossible to get the rivet hold-up dolly to do any more. I did afterwards put a dozen or so of phosphor-bronze screws in another row.

The firehole door ring was tinned, the holes drilled in the inside firebox plate, and riveted up. The ring was made a tight fit for width and pushed up into position between the plates.

The centres of the holes for staying the inner and outer fireboxes was done in the LBSC method and the threads cut, using good cutting oil. The foundation ring's ¼ in. × ⅜ in.



copper bar was riveted with 3/32 in. close pitch rivets, and a ⅜ in. square piece for the backhead. I should mention that the expansion angle brackets had been riveted to the outside firebox wrapper plate.

Then followed a long session with the blowlamp, Fry's paste and 16-g. solder wire. After going all round the wrapper joints, barrel and front tube plate joints, the cross stay nuts were slacked off. One side at a time was done, the paste being painted on thread and plate, melted and the nut tightened down. This resulted in a nice fillet round each nut. All the nuts of the crown of the outside wrapper were treated the same. The firehole door ring and the foundation ring were also finished the same.

A hydraulic test to twice the working pressure was made. I then had a long session of making the boiler fittings.

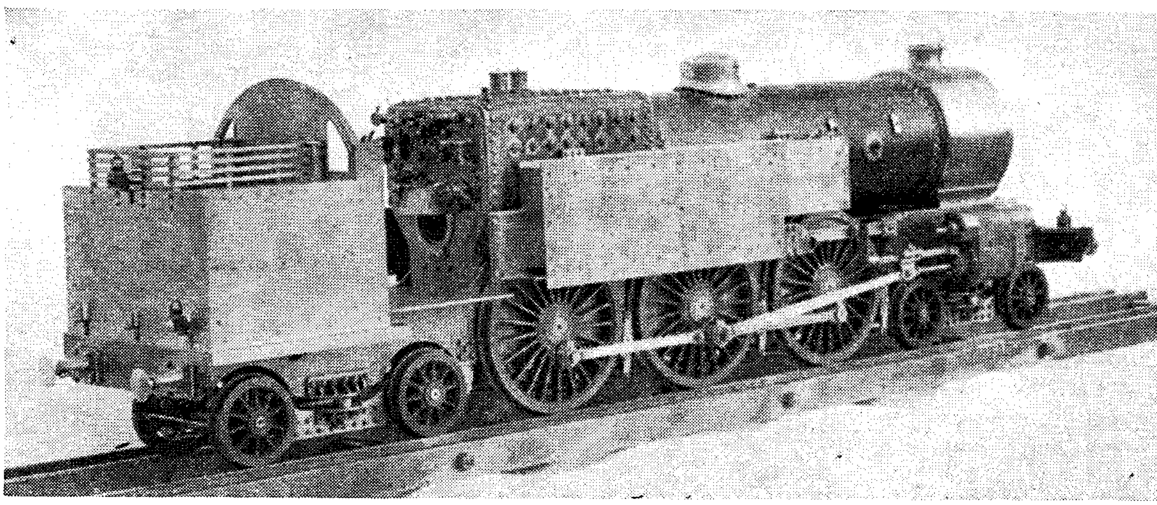
The firehole door fittings have the tray and glare shield fitted and the door has the correct latch, air adjusting catch and lifting chain fitted. The regulator handle has the correct six studs and nuts and stuffing-box gland fitted, and the front spectacles of the cab are not obstructed by any fittings.

The superheater was made something like the drawings and started off with a piece of flat brass bar, with two $\frac{5}{16}$ in. dia. holes drilled the full length of the bar and the ends plugged and silver soldered. A shaped block was fitted on the middle of the bar, on the back edge of the bar, with a flange and a spigot joint at the back which received the end of the regulator steam pipe. The headers are held to the smokebox tubeplate by five hexagonal head bronze setscrews.

The back bore of the header is the wet steam from the boiler to the top of the wet header and the cylinder lubricating pipe is connected into the centre of the dry one as per GWR. The problem then was to get the lubricating pipe from the lubricator in the cab to the header, but eventually it was solved by enclosing the oil pipe inside a representation of the vacuum exhaust steam pipe which, with suitable connection on boiler and smokebox, allowed my oil pipe to travel in a free and level line.

The smokebox door with its lovely Claud Hamilton steel ring and hinges, is held tight by the dart bolt and a huge wheel. When making this wheel in stainless steel I often wondered if I should be pulled to pieces by fitting such an oversize atrocity. The GER did not have wheels on their smokebox doors except on one engine, built in 1902, and then the most powerful locomotive in the British Isles.

I have a set of 1½ in.-1 ft scale drawings from Stratford works with the official stamps on, of the *Decapod*, the enormous 0-10-0 tank engine, built to contest the Electric Railway Bills that were before Parliament at that day. The wheel on my engine is half the size of the one on these official drawings.



On the photograph of the backhead you will see most of these, and more have been added. Note the cleaning plugs on Dewrance water gauge and the steam sanding valve on the right-hand side, which was always the GER driver's side, and on the left side a hydrostatic sight-feed lubricator which is a copy of Austen Walton's one on his *Twin Sisters*.

The fittings include right- and left-hand injector steam valves, three cock Dewrance water-gauge column, steam brake valve, steam-sanding valve, pressure-gauge fitting, steam valve for hydrostatic lubricator, Dewrance quick-action blow-down valve, and a scale whistle which takes steam from the boiler. They are arranged as near as possible to those on the Claud Hamilton class engine of the GER, so many of which I worked on during my apprenticeship at Stratford.

superheater tubes, which are three ¼ in. dia. copper pipes with the block ends brazed on and returning to the front bore of the header. These were silver soldered in their respective back and front bore.

The outside cylinder steam pipes are connected to the front of the dry header by a spigoted flange joint with four hexagonal head setscrews. The only way I could get the pipe to fit inside cylinder was by a flanged elbow spigoted and silver soldered in the top face in the dry steam bore; as I had to clear the chimney petticoat and come down to connect to the inside cylinders in front of the blast pipe arch.

I made the bends in the copper pipe and fitted a circular spigoted flange to the inside steamchest and then silver soldered into the header.

The snifting valve is fitted to the

The chimney and dome cover I thoroughly enjoyed making. On big sister they were pressed in sections and brazed together from ⅛ in. steel plate, and the chimney had a lining in as well. I fly cut the bases to the radius of smokebox for the chimney first, and the dome to the radius of the boiler and then machined on spigots after boring out to size.

This I think completes the boiler operations and now remains the tanks, bunker, cab and fittings and all the gear under the cab floor.

★ *To be continued*

The FLEET-FOOTED SHIRES

IN selecting the D49 4-4-0 for "Library of Locomotives," Robin Orchard certainly made a fine choice.

I have always considered the Shires the most handsome modern 4-4-0 in Britain. I think the outside steam pipes and poppett valve gear marred the appearance of the Hunts.

In recent years a few Shires were shedded at Thornton depot and they used to haul the Glasgow passenger trains. They did the job splendidly. They may have been called "rough riders" by the footplatemen but they could certainly run.

I remember returning from a visit to Glasgow in 1957, travelling home with the 5.18 p.m. from Queen Street. The engine was No 62704 *Stirlingshire* and she was ten minutes late getting away.

On getting the road the crew set to with a will. The characteristic ring of the Gresley rods, and the crackle of the three-cylinder exhaust echoing in Cowlair's cutting made an unforgettable sound.

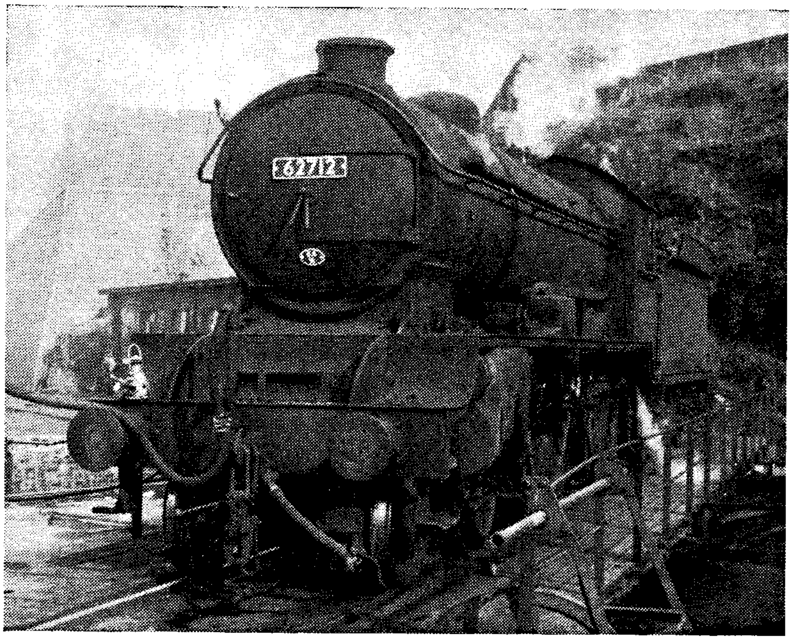
After dropping the banking engine at Cowlairs station *Stirlingshire* shot away and made a most exhilarating run. It was in Kirkcaldy two minutes ahead of time.

I feel that one cannot talk about the Shires without mention of that brilliant run timed by Mr O. S. Nock which involved No 249 *Aberdeenshire* on the 1.20 p.m. "Down Scotsman." The driver was the well-known Norman McKillop and the fireman Jimmy Sellar, then both in the Haymarket spare link.

The task set the engine was a formidable one for a 4-4-0 of such dimensions. *Aberdeenshire* had to take a 435-ton train from Newcastle to Edinburgh without assistance. One of the feats of the run was the maintenance of a minimum speed of 46½ m.p.h. up the 1 in 200 to Grantshouse. (A detailed log of the brilliant performance appears in Mr O. S. Nock's book *The Locomotives of Sir Nigel Gresley*.)

In view of the fact that the photographs in Robin Orchard's articles were of the Hunts, I have enclosed a few photographs of the Shires which may interest readers.

WILLIAM OSWALD.



Top: *No* 62729 RUTLANDSHIRE *emerging from the tunnel at Kinghorn with the* 11.25 *a.m. Edinburgh to Thornton Junction stopping train.* *Right:* 62712 MORAYSHIRE *on the turntable at St Margarets sheds. This engine is fitted with a release wire to the forward coupling for use when doing rear banking work*

READERS' QUERIES

- Queries must be within the scope of this journal and only one subject should be included in each letter.
- Valuation of models, or advice on selling cannot be undertaken.
- Readers must send a stamped addressed envelope with each query and enclose a current query coupon from the last page of the issue.
- Replies published are extracts from fuller answers sent through the post.
- Mark envelope "Query," Model Engineer, 19-20 Noel Street, London W1.

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

Electric clocks

I have two PM books, *Electric Clocks and How To Make Them* by F. Hope-Jones and *How To Make An Electric Clock* by R. Barnard-Way. Could you kindly give me the address of anyone who can supply the wire in small quantities for the electro-magnets, as I do not like messing about with mains voltage?

I would like some information on the magnets.

I have been a reader of ME since early 1930 and with my brother have built two 3½ in. gauge locomotives. The first, an 0-4-0 side tank, was begun during the war and completed in 1949. The second was started in 1950 and completed in 1960; I had three serious illnesses and work was suspended for long periods. We also have a 1¼ in. gauge *Myrtle* with a larger boiler than LBSC specified.—J.H., Stoke-on-Trent.

▲ *Wire for winding electro magnets is manufactured by the London Electric Wire Company and by Smiths Limited, 24 Queen Anne's Gate, Westminster, London SW1. Smiths have stockists in most large towns.*

The size of magnets, gauge of wire and number of turns vary widely in different types of clock. Theoretically, the amount of power required is very small. The windings for low voltage in the clock described by R. Barnard-Way may be taken as a basis for the windings in other clocks.

Centrifugal clutch

I am making use of your excellent queries service, as I am in need of a centrifugal clutch pulley which I hope to make.

I would be very grateful if you would explain the internal workings.—D.M., Methlick, Aberdeenshire.

▲ *In the usual centrifugal clutch, the driving member has friction shoes attached or pivoted to it, similar to the brakeshoes of an ordinary expanding brake. The drum corresponding to that of a brake is mounted on the driven shaft. The shoes are fitted with tension springs, so that they do not normally make contact with the drum, but at high speed the centrifugal force exerted on the brakeshoes overcomes the springs and causes the shoes to make contact with the drum at varying pressure, depending on the speed.*

It will be seen that a clutch of this type transmits no power at low speed, but as the speed increases it exerts an increasing driving force. Constructional details vary widely, but the general principle is the same.

Colours for Tich

I have been engaged in building the larger-boilered 3½ in. gauge *Tich* for some time and have managed to progress almost as far as a steam test. Now I have encountered a problem which appears to confront other readers of ME from time to time: what would be a suitable colour scheme? Does one use gloss or a matt paint? Can you recommend a suitable paint for the smokebox, as I believe this attains a higher temperature than other parts of the boiler? I wrote to a leading paint manufacturer but did not receive the courtesy of a reply (even with a stamped addressed envelope).

I have been an ardent follower of MODEL ENGINEER since I "discovered" it in 1950; I consider that it has reached a peak in style, presentation and vitality from about 1953 onwards.—T.G.A., Peterborough.

▲ *A suitable colour scheme for* TICH *would be mid-green, with black smokebox, cab roof, running board, wheels and so forth. A very dark blue (like old GER) also looks well.*

While matt paint looks much better, it is not durable and so gloss is preferred. The best way is to use a proper undercoat and build up a good body with three to four coats, rubbing down between each of them.

After lettering, apply a good coat of best carriage varnish—but not on the smokebox.

You can obtain a good black paint from Mander Brothers of Wolverhampton, who also make the varnish.

Round bed

I have bought a Drummond Round Bed lathe. Although it is rather aged it is in good condition, but I cannot see how to set the tailstock so as to be certain of parallel turning.

Up to now I have used the trial and error method, but I think that there must be some other way! The tailstock, as you will know, swings past the dead centre on the round bed.—F.C.S., London NW9.

▲ *The setting of the tailstock has always been somewhat difficult in this lathe and, generally speaking, must be adjusted by trial and error for parallel turning between centres.*

Various methods have been suggested for improving the method of alignment employed, but the trouble is that, however carefully the tailstock is lined up, it is liable to move when the clamping bolt is tightened.

Cutty Sark

I wonder if you can help me? I need 12 ft of 36 to the inch chain in brass or steel. I am making a model of the *Cutty Sark* at ⅛ in. scale.

I read my first MODEL ENGINEER in 1933 and I still enjoy the magazine every week.—P.W., Bristol.

▲ *The Web Model Fitting Company of 204 High Road, Wood Green, London N22, might be able to supply the chain you require, although 36 links to an inch is rather fine.*

Mr N. Poole of 20 Eastover Close, Westbury-on-Trym, near Bristol, might be able to give you an address. He is in the Bristol Ship Model Club.

Bigger Molly

I am a lone-hand, and have no connections with any club. I recently completed a *P. V. Baker* with *Bantam Cock* cylinders and I am delighted with the results. I have track-tested the engine on a friend's up-and-down line (the friend, too, is also a lone hand). Getting up, and maintaining steam proved child's play, much to my consternation and the engine was apparently a complete success.

I thereupon decided to build my own up-and-down line (such as I can accommodate), much to the delight of my two young sons. So far I have built a passenger car and the first 48 (of 100) ft of track.

Several months ago I bought from a friend some parts of *Molly*, with a view to completing the engine myself, my friend's only condition being that he be allowed to have a drive.

Of course, I readily agreed but I am afraid that fate took a hand; my good friend died in rather tragic circumstances. I think perhaps he might have known what was to happen when he let me collect the pieces months before. They consist of most of the chassis including the frames, wheels, crank axle (one piece), the axles and connecting rods, and most of the valve gear all of first-class workmanship.

As *Molly* is very similar in outline to *P. V. Baker*—too similar in fact—I would like to build her in a bigger form, but with no more power. I have toyed with the idea of lengthening the frames to make possibly a 2-6-2T or a 2-6-0 tender engine.

I wonder if you would consider such a job practicable ? Could one of your other engine's boilers be modified to fit on the *Molly* frames ? Perhaps I could have lengthened *P. V. Baker* boiler, as this appears to have steam to spare ?

If an engine of similar arrangement as *Molly* but in 2-6-2T or 2-6-0 form, with inside cylinders, has ever appeared on a railway I wonder if you could name it, so that I could try to obtain a photograph.—J.B., Manchester.

▲ *While it would be quite a satisfactory operation to extend the frames of your* MOLLY *at either end, and to add pony trucks and so forth, you are strongly advised not to alter the cylinder valve gear arrangement unless you have considerable knowledge of this work.*

The same applies to the boiler. For instance, the addition of, say, $1\frac{1}{2}$ *in. to the length of the barrel without any other alteration might well spoil the boiler as a steam producer.*

There were some very odd 2-6-0 *and* 2-6-2 *engines on the older railways. They included the Caledonian* 2-6-0 *tender goods engine with inside cylinders, the GWR Aberdare* 2-6-0 *goods with outside frames but inside cylinders, and the LYR* 2-6-2T *with inside cylinders—Hoy's engine.*

Garage light

I have a garage 60 ft from the house, with an electric supply through a mineral-insulated cable run underground. Annoyance has been caused through the light being left on all night.

Can you tell me of a way to get a pilot light to come on when the garage switch is on ? For instance, could a coil be fitted around the live leg of the pyro cable to give sufficient power to light a neon lamp ?

It is impossible to reach the garage, so that anything to do must be done at the intake, in the house.—F.T., London N14.

▲ *It would not be practicable to operate an indicator lamp by fitting a coil around the live wire of the supply cable. This would not have any transformer effect, as the magnetic lines of force would be at right angles to each other.*

You could obtain some inductive effect by laying a wire parallel to the live cable, but it would have to be of some considerable length to provide sufficient inductive power to light a neon lamp.

Undoubtedly the simplest method would be to provide a main switch to the garage at the house end. What objection can there be to this? Alternatively, a meter having a rotating disc could be fitted at the house end. It is possible to obtain discarded electric watt-hour meters fairly cheaply on the surplus market.

Off with his head !

I am a beginner to model engineering and have been drawn to it by the MODEL ENGINEER articles on traction engines; I have had a passionate interest in traction engines ever since I first saw the late J. Nichols's pair of ploughing engines at work at Everleigh, in Wiltshire, some 30 years ago.

Will ordinary bronze welding be suitable for the boiler construction of a 3 in. scale boiler ?

Where can I buy books on boiler building and traction engine construction ?

I have an air pressure gauge marked up to 150 p.s.i., will this be suitable for steam ?

I am beginning on a 3 in to 1 ft scale engine because I want a working model which is robust and big enough to stand rough treatment. It need not be a showroom model. I have a $3\frac{1}{2}$ in ML7 and all the usual small tools, with oxy-acetylene equipment and a forge on which I intend to make the rear road wheels because they will be too big to turn from castings in the lathe.

Please let us have more articles on traction engines in MODEL ENGINEER, as I am sorry to say that I cannot work up much enthusiasm for railway engines—a sacrilegious statement to some. no doubt!—S.S., Lechlade, Gloucestershire.

▲ *Bronze welding is quite suitable for the construction of a* 3 *in. scale boiler.*

There seems to be no books dealing specially with boiler building or traction engine construction, but numerous articles on this subject have appeared in ME.

Most air pressure gauges work quite satisfactorily on steam, but in any event it is important that the communication with the boiler should be through a siphon tube—a U-tube in which condensed water can collect and isolate the mechanism of the gauge from the heat of the boiler.

W. J. Hughes's A Century of Traction Engines, *contains a great deal of detail and illustration which would be helpful in modelling.*

Can You Help ?

Readers who can offer information to those whose queries appear below are invited to write c/o Model Engineer. Letters will be forwarded.

Cardiff school to build organ

I seem to remember seeing in one of your earlier issues of ME some suggestions on the building of a small organ.

We are contemplating building one as a major school project over the next two years and I wonder whether you could help us with drawings or advise us whom we should consult.—S.N.J., Cardiff.

ANYONE CAN BUILD THIS DUTY BOAT . . .

Continued from page 523

Because the noise from these little engines can become a nuisance on the local pond, we introduced a RipMax silencer and, to get a longer run, we added a fuel tank supplied by the same company. They fit very neatly and are easily accessible if any of the parts have to be removed at any time.

Finally, the cabin was fitted, and finished off with Humbrol paint.

All the fittings, such as cleats, searchlight and klaxons were supplied by RipMax, and there is no doubt that when the vessel was given her trials in the water she looked impressive and realistic.

The kit costs 47s. 6d., without the stern tube and propeller, from any high-class model shop. ▣

POSTBAG

The Editor welcomes letters for these columns. A PM Book Voucher for 10s. 6d. will be paid for each picture printed. Letters may be condensed or edited

TIME-DELAY

SIR,—Before the war a time-delay device [Readers' Queries, March 8] was manufactured by Kodak. I doubt if it is still in production, but I feel sure that it may be had on the second-hand market.

The device, which was about 2½ in. long, consisted of a closed-end cylinder with piston and piston rod. A strong spring was fitted above the piston on the compression side, and an adjustable air valve was provided at the end of the piston rod, which was drilled to communicate with the vacuum space.

When the piston rod was depressed as far as it would go it compressed the spring. A catch locked it in that position. When the catch was released, the spring pressed the piston upwards, but it was unable to travel far because of the vacuum created. Air leaked through the valve and gradually released the vacuum. When the piston reached a position about two-thirds along its stroke, it uncovered a small port which allowed air to rush in so that the spring could complete its work.

The timing of the delay could not be accurately estimated as it could be found only by trial and error, but it could be varied between a few seconds and two hours. There were also Swiss clockwork timers about the size of a pocket watch. Their timing could be accurately set, but the longest delay was about two minutes.

Both devices operated the standard cable release.

Bury St Edmunds, GERALD LAMBERT.
Suffolk.

BOILER STRESS

SIR,—I would like to add a few words to K. N. Harris's letter of March 24 on boiler stress. In R. H. Clark's *Chronicles of a Country Works* is a photograph of an erecting shop (page 200). At least eleven engines are shown under construction with double-row riveting in longitudinal seams and single-row on circumferential ones. Mudholes are shown with their major axis parallel to the longitudinal centreline of the boiler.

Two complete engine boilers are seen before the cylinder blocks have been fixed, and as no holes or markings are visible on the boiler shell I would like to know what method was used to position them. I presume that a spirit level was used for part of the work, as no markings are shown for the funnel either.

Readers interested in engines will find *Chronicles of a Country Works* extremely interesting.

Best wishes to the staff of ME.

Maidstone, R. SIMONS.
Kent.

HORSE VEHICLES

SIR,—I was very much interested in the article on building a mail coach by Cecil A. Hewitt. In trying to make a collection of horse-drawn vehicles, I find it very difficult to get the information and plans.

Can anyone help me with information on coaches, landaus, victorias and cabs?

My picture is of a Cobb and Company mail coach which began running in New Zealand on 11 October 1861.

Brighton, JOHN C. LELLIOTT.
New Zealand.

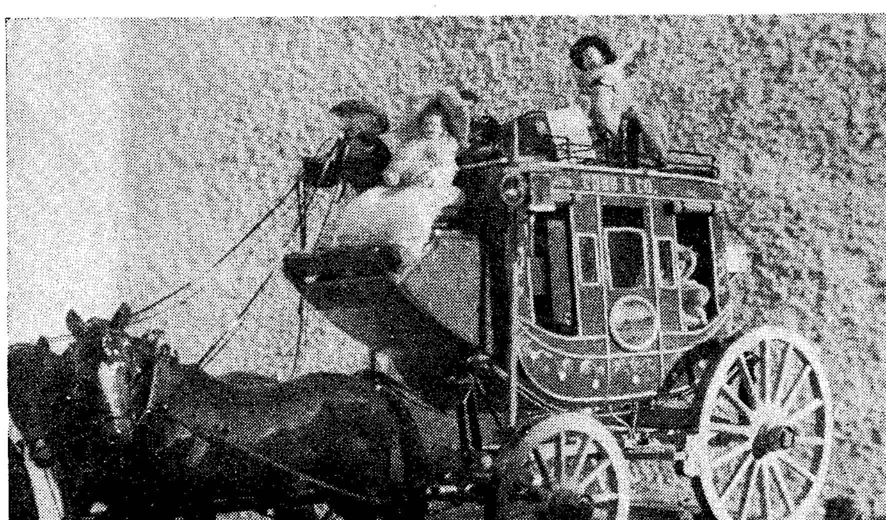
LEFT HAND

SIR,—I greatly appreciated the article "Steam does it Better" by Robin Orchard, on the Fowler ploughing engines working in Essex. How I wish I could have seen them, too!

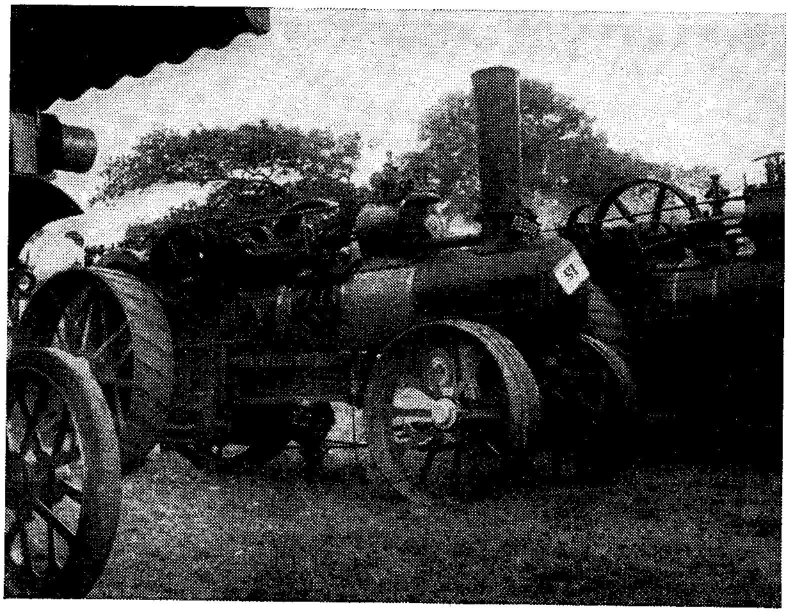
I note the remark, on the sharp bark of the exhaust. Evidently the driver was working in "double eye" at that moment. I have pleasant memories of the thudding "duff" of a fully-loaded compound engine; only when the simpling valve is opened does it really bark.

The two-speed gear wheels are plainly visible in the excellent photographs.

In Postbag of 1 December 1960 were a letter and three photographs from Mr J. Davies, formerly of



This Cobb mail coach first ran in New Zealand on 11 *October* 1861. *John C. Lelliott of Brighton, Dunedin, is interested in models of horse vehicles*



Left-handed Fowler. According to a rally catalogue, it was built in 1914

Bideford. Two of the pictures related to full-size practice, and the third was of his own model traction engine. All three had left-hand cylinders.

Fowlers also built a left-handed engine; I have a photograph of one. The tick-tock lubricator is by Foster of Leeds.

A rally catalogue gives 1914 as the building date, but the engine curiously reminds me of a pair owned by Earl Dudley at about the beginning of this century.

Newcastle upon Tyne. E. H. JEYNES.

FUTURE TRAINS

SIR,—Long-range underground trains would have a smooth-bore tunnel, ground-effect suspension, gyro stabilisation, jet reaction propulsion, and double-deck cabin. Power pick up would be by induction and not by wipe contact. Safety stopping would be by opening slots in the tunnel floor when the signal turned red, thus breaking the air bearing suspension.

One fault in the present London Underground short-stage system is the standard gauge upon which it is based. The District and Metropolitan lines were cut-and-cover lines based on standard rolling stock. Later lines made the most of the space and were able to push the stock through a toothpaste tube. If future tunnels are bored to take double-deck trains on a broad gauge, passenger capacity will be three or four times as high. Two-deck, two-side loading will improve turn-round.

Contrary to popular belief, deuterium will not be stripped from sea water. The high purity required of nuclear materials and the high cost of the chemical processing turns attention to the tail-races of hydro-electric stations.

Apart from the aluminium works in Scotland, I do not know of any large source in this country. The nuclear station cooling pond at Trawsffynyd is, I believe, run through a hydro-electric unit during peak hours and pumped back by a fossil burning unit during off-peak hours. We may be economically justified in buying deuterium dioxide from a future Kariba Dam plant.

East Ham, London. A. E. CLAUSON.

GENERAL INTEREST

SIR,—More articles of general interest? *Yes, please!* And some advice and suggestions for models other than railway engines. There are hundreds of things that can be modelled. The ME Exhibition always gives some new ideas, and even the specialist must be tempted sometimes to produce something unusual.

My modelling always turns to ships, but I would welcome a few details for vintage cars or motorcycles, beam or mill engines, aeroplanes, a roundabout, period artillery, and even an excavator —to mention a few subjects that would help to ease us all out of the rut.

I am afraid that the mechanically-minded who are not interested in the railways of the world are sadly neglected in their magazine.

Looking forward to a little more variety.

Wimbledon, London. A. J. BAKER.

NORTH BRITISH

SIR,—The end of the North British Locomotive Company poses the question: what is to become of the company's archives, right back to the time of Dübs and Company and the other firms which were absorbed?

I suggest that a plan be put forward, in co-operation with the Science Museum or the City of Glasgow, to buy the collection outright. If the company is to cease trading this had better be done quickly before the archives go the way of the models that the great McKay of Boston (see the two articles by Joseph Martin) left behind him.

London. H. H. NICHOLLS.

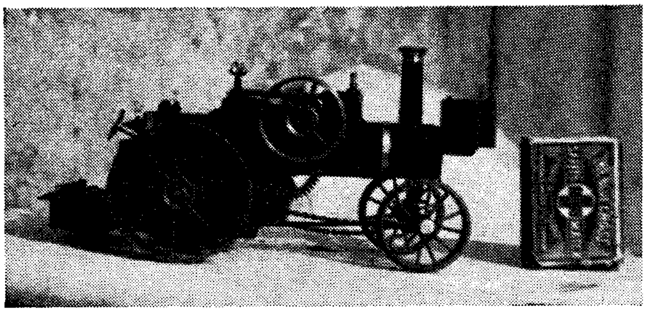
SOUTH BEND

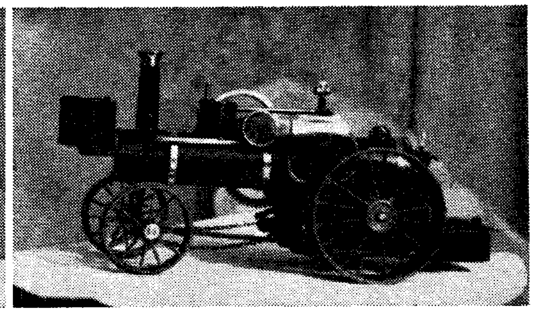
SIR,—In reply to the query of W.S. in Queries of March 15, a South Bend lathe is supposed to have a bracket on which another gear wheel is fitted if metric threads are to be cut. Here is an extract from the book on South Bends: "In order to cut standard metric threads on a SB lathe a transposing gear attachment is used. It consists of a two-arm bracket to which are attached two transposing gears of 50 and 127 teeth respectively, and an idler gear to connect the 50-tooth gear with the gear on the leadscrew. Additional change gears are used for cutting the various metric pitches shown in the index charts. . . .'

Here is the chart for a standard change lathe:

MM pitch	Stud gear	Comp gears	Screw gear
0.5	24	127-50	80
0.75	36	127-50	80
1.0	48	127-50	80
1.25	60	127-50	80
1.5	36	127-50	40
1.75	42	127-50	40
2.0	48	127-50	40
2.5	60	127-50	40
3.0	72	127-50	40
3.5	42	127-50	20
4.0	48	127-50	20
4.5	54	127-50	20
5.0	60	127-50	20
5.5	66	127-50	20
6.0	72	127-50	20
6.5	78	127-50	20
7.0	84	127-50	20
7.5	90	127-50	20

Walthamstow. G. E. JAMES.





Between Cornwall and North America ties have always been strong. Cornish societies in the United States would appreciate this model of an American traction engine produced by John J. Rogers of Penzance in about 100 hours

CORNISH AMERICAN

Sir,—I have recently completed a model at $\frac{3}{8}$ in. scale of an American Buffalo-Petts, single 25 h.p. side-mounted, and powered by a $\frac{1}{4}$ in. bore $\times \frac{5}{16}$ in. stroke cylinder, with a boiler $\frac{7}{8}$ in. dia. $\times 3\frac{3}{4}$ in. long.

The engine will steam for 15 minutes and pull 10 lb. on a trailer, on concrete. She is fitted with working steering, runs at 25 p.s.i., and is fired by methylated spirit.

I painted her Brunswick green, with red wheels. Her stack flare, boiler bands and fittings are of polished brass.

The work took me about 100 hours.

Penzance, Cornwall. JOHN J. ROGERS.

PLASTIC VALVES?

Sir,—In this age of plastics has any experimenting been done with this material in check valves—particularly lubricators?

If there has, I am sure that many readers would be interested to know the results

Aberford, Yorkshire. A. G. BENNETT.

CAVAN RESCUE

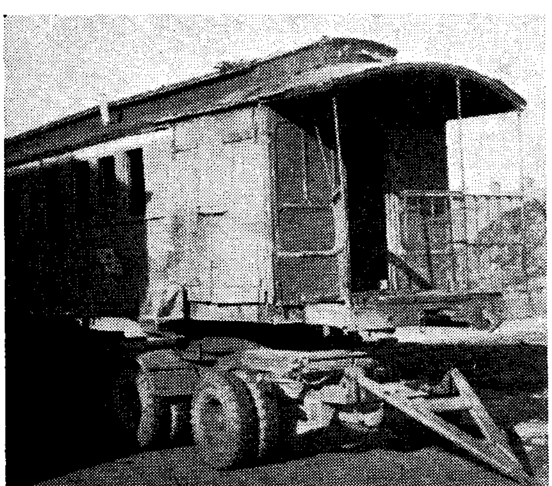
Sir,—I anticipate that you may hear directly from the Curator of the Belfast City Museum and Art Gallery's Transport Section, but pending Mr R. B. Beggs writing to you, I feel that the following facts on the Cavan and Leitrim vehicles may be of interest.

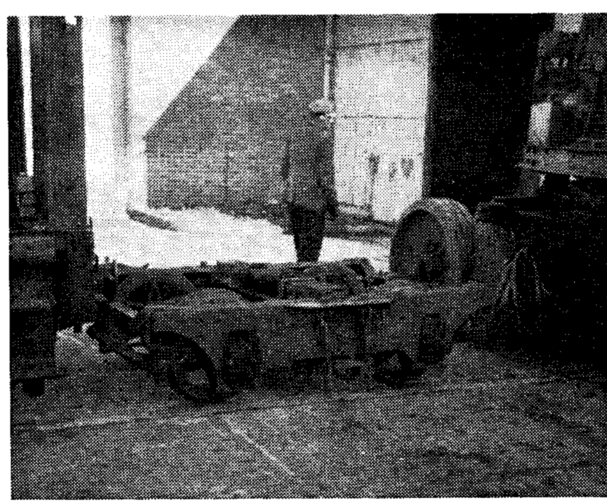
Both the locomotive and coach seen by your contributor are now at the Belfast Transport Museum's Whithour Street premises. (Locomotive in late 1961; coach in February 1962.)

The Corporation's Museum and Art Gallery committee agreed early in January that as one who had been active in campaigning for the "rescue" of these vehicles—first earmarked for Belfast two years ago!—I should appeal publicly to enthusiasts for funds to help in the restoration of, particularly, the coach—in effect, creating a society of "Friends of the Belfast Transport Museum." The final wording of the public appeal is with Curator Beggs *now* and when this reaches you I hope you may be able to give the matter appropriate publicity.

The Belfast collection is by far the most representative—outside that of the BTC—yet assembled. I shall be in Belfast, and working part of the time on the C and L at Easter.

Poulton le Fylde, Lancashire. F. K. PEARSON.





Left: Cavan and Leitrim first-and-third brake No 6 arriving at Belfast Transport Museum in February. The end panelling visible represents the original overall styling. It is hoped that the body sides will regain this appearance when the brake is restored. The van doors, another later addition, will be taken off. Right: Coach bogie. Note the compact construction in 3 ft gauge. (Photographs by courtesy of R. B. Beggs, the Curator)