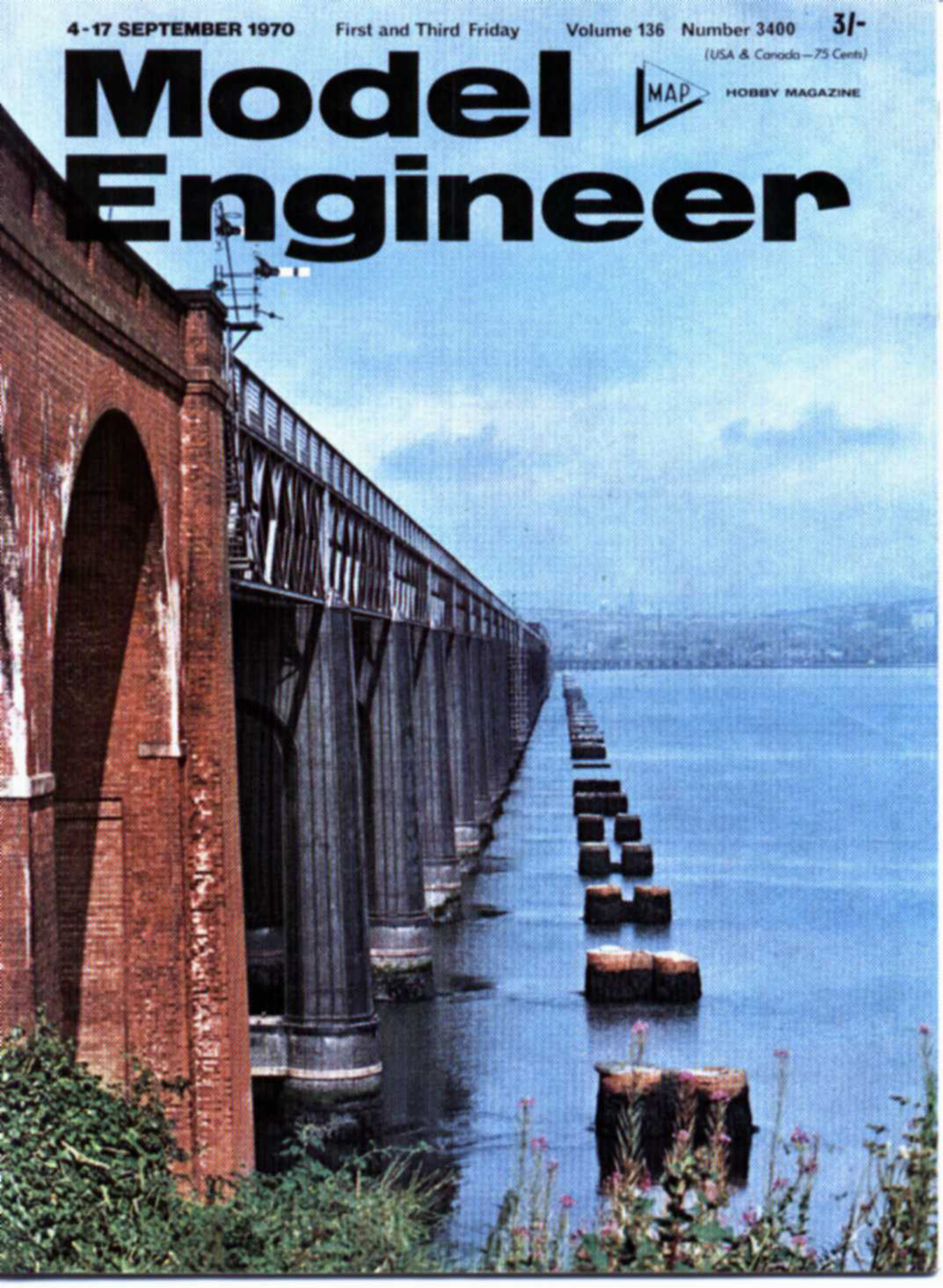
4-17 SEPTEMBER 1970 First and Third Friday Volume 136 Number 3400 3/-
(USA & Canada—75 Cents)

Model Engineer

MAP HOBBY MAGAZINE



Model Engineer

MAP

Founded 1898

Incorporating Mechanics and English Mechanics and Ships and Ship Models

Volume 136 **Number 3400**

September 4 1970

CONTENTS

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

MODEL & ALLIED PUBLICATIONS LTD.

COVER PICTURE

An unusual view of the Tay Bridge, showing the foundations of the old bridge alongside. Colour picture by J. H. Balleny.

NEXT ISSUE

How to make the two-throw crankshaft for "Princess of Wales."

Subscription 82s. (U.S.A. and Canada $10) post free, index included.

Editorial and Advertisement Offices:

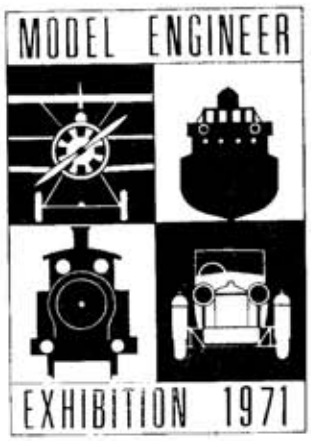
13-35 Bridge Street,
Hemel Hempstead, Herts.
Hemel Hempstead 2501-2-3

ABC

MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

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

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



40th GREAT SHOW!

Model Boats, Cars
Aircraft, Locomotives
Traction Engines
Military Models
Crafts

★ RADIO CONTROL POOL
★ CAR RACING CIRCUIT
★ MODEL STEAM PLOUGHING

29th DECEMBER 1970
TO
9th JANUARY 1971

SEYMOUR HALL
LONDON W.1.

COMPETITORS
Your entries are now invited. Entry Forms on request. £300 in prizes . . . some 30 cups, trophies and other awards. Championship Cups for permanent retention. A win confers "Expert Status"!

ENTRY CLASSES
Examples of every form of modelmaking activity can be be entered. Model engineering masterpieces such as locomotives, traction engines, aircraft, boats, cars . . . or simple plastic creations . . . there is a class for you. New classes this show will include Military Models (six classes) and Craft entries (Furniture, glass fibre, etc.).

SEE & BUY
Full model trade support with well stocked stands. Stands have been taken by Beatties of London, Model Hobby Consortium, Myfords Ltd., Graham Farish Group Sales Ltd., The Turntable, Kennions, Traction Engine Enterprises, Wall Models, Historex, Mainstream Productions Ltd., Faller, Plaistow Pictorial . . . with others to follow. . . .

SPECIAL ATTRACTIONS
Last year's popular pool with working space around will be there again —located in the centre of the main hall. Aircraft will again be showing their paces above the pool. Boats will be available for visitors to try. . . . The Society of Model & Experimental Engineers will be operating their famous passenger carrying model steam locomotives—some wonderful models at work under the direction as ever of Mr. Bill Carter. Other models under compressed air in action.
NEW! A demonstration of steam ploughing by model traction engines (Even better than when shown on TV!) The ECRA Championship car circuit (a little tight for room last year) moves into a larger hall. Longer track, more spectator space. Jock Thin and Dick Smith welcome you again. Other new attractions will include model soldiers, guns, dioramas. Display of woodwork and craft items. Demonstrations of various kinds. Small lecture theatre for film shows, model subject talks.

SOUVENIR GUIDE
Another CHRISTMAS EXTRA issue of *Model Engineer* will be coming out 2nd Friday in December with entries, trade stands, articles galore to assist the visitor and solace the stay-at-home.

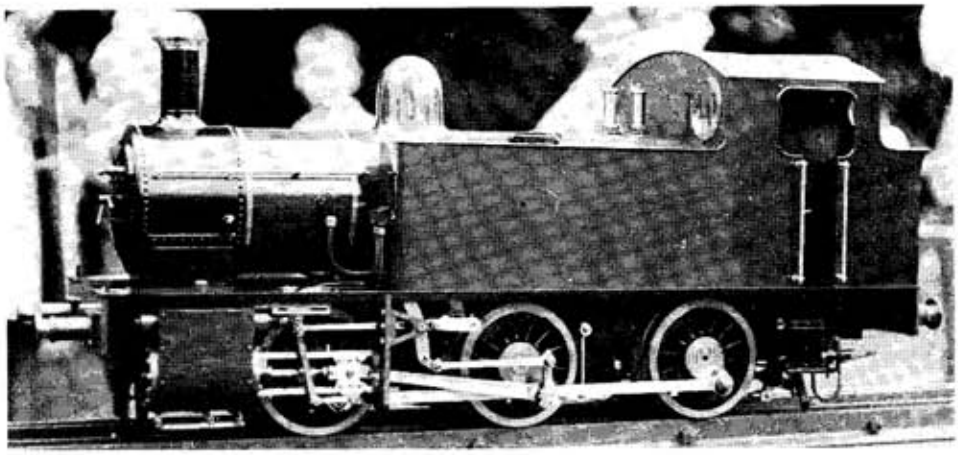
PRIZE POOL ALLOCATION
Classes attracting six or more entries will enjoy prizes to value of 1st £5; 2nd £3; 3rd £1. With over 12 entries 1st £7; 2nd £4; 3rd £2; 4th £1. Classes under six will have 1st & 2nd only, or at discretion of the judges may be combined with other classes.

ENTRIES' CLOSING DATE
All entries must be made by October 19th, 1970.

TICKETS:
Pre-booking concessions. Parties (10 and under), Adult, 4/6; Child, 2/6d. (More than 10), Adult, 4/-; Child 2/-. Teachers i/c parties, free —one per 10 in party. Paybox Admission: Adult, 5/-; Child, 3/-.

Enquiries for Competition Entry Forms, Trade Stands to EXHIBITION MANAGER, M.A.P. Ltd. 13-35 BRIDGE STREET, HEMEL HEMPSTEAD, HERTS.

MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION MODEL ENGINEER EXHIBITION



This almost completed "Simplex" by Mr D. Forster of Stockport was seen at the I.M.L.E.C. at Blenheim, though not entered.

SMOKE RINGS

A commentary by the Editor

Main Line preservation

Most readers will have heard of the Main Line Preservation Group. This group hopes to purchase a length of British Railways' main line for the running of steam-hauled trains, which it believes will prove a lasting attraction to tourists, railway enthusiasts and students of the locomotive.

The aim of the group is to obtain a 19 mile length of the old double-track main line between Leicester (Abbey Lane) and Ruddington (Notts.). It is hoped that once this has been successfully accomplished, it will be possible to arrange for the running of many of the famous steam locomotives now preserved. The Leicester Museum of Technology have already expressed their willingness to allow one of their exhibits, the V.2 class engine *Green Arrow*, to become a permanent working locomotive on the line.

The stretch of line concerned is little over 70 years old; it was the last main line to be built in Britain and is today in a structurally sound condition. It is able to accommodate the heaviest express engines and is suitable for high speed working. The present position is that a bid for the line has been made to British Railways for the Leicester-Loughborough section and provision made for further negotiations for the stretch onwards to Ruddington. While the necessary deposit may be found in time, financial support is urgently required if the scheme is to be successful.

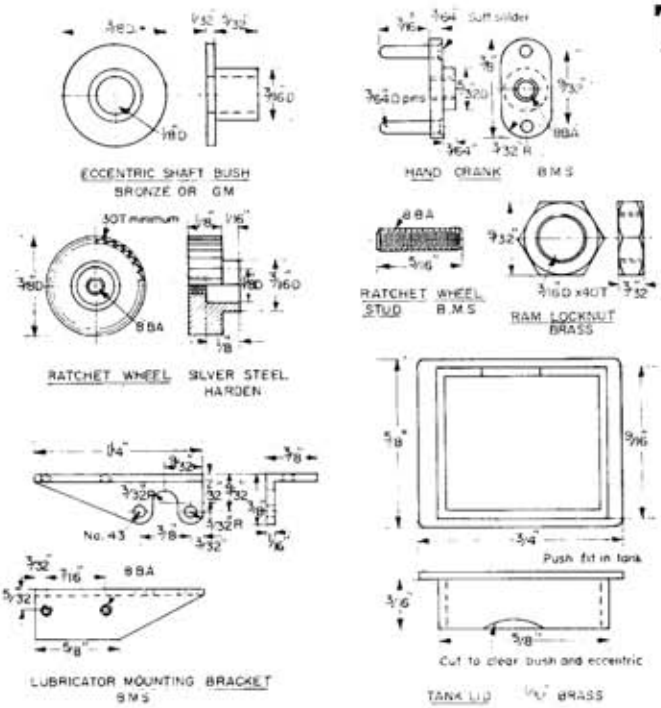
Applications for membership, loans and donations should be made to Mr Richard Lovatt, 10 The Broadway, Oadby, Leicester.

I.M.L.E.C.

With the success of this year's competition, it looks as if I.M.L.E.C. will have to become a permanent feature on the model engineer's calendar. At the first competition, on the track of the Birmingham S.M.E., there were approximately 450 visitors. At Blenheim this year there were over 600, so it will be appreciated that the task for the "host" Society is an onerous one. Nevertheless, I very much hope that those societies which have the space for the visitors' cars, and the necessary facilities for the locomotives, not to mention the track itself, will once again rise to the occasion, so that we can keep the Competition going.

It would be nice if we could have the 1971 event in the North of England. (It must be remembered that to a northerner, even Birmingham is "south"!) Whether there are tracks and sites capable of coping with I.M.L.E.C. up in the North is something which at the moment I am not certain of, but hope to discover this autumn. In the meantime, I will be very pleased to hear from any club secretary who would be prepared to undertake the organisation of the 1971 Competition.

One of the younger I.M.L.E.C. competitors, Mr E. Kellett and his "Ivy Hall" on the steaming bays. *Full report on page 856.*

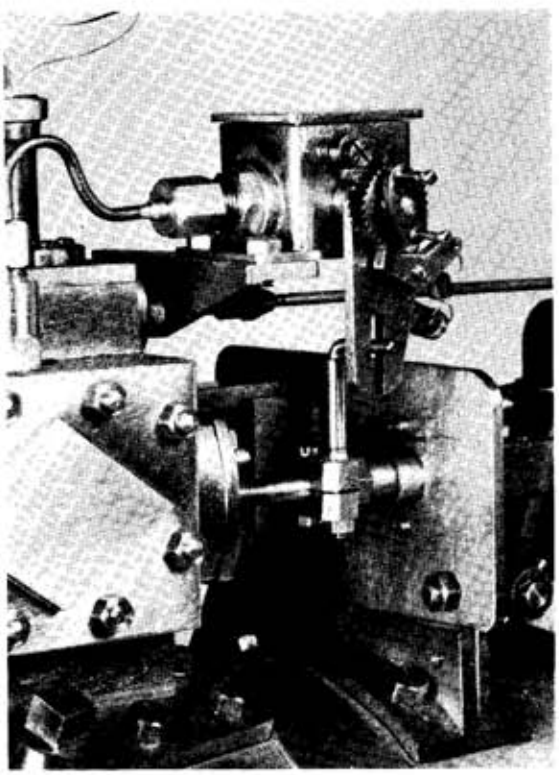


THE "MODEL ENGINEER" TRACTION ENGINE

Built and described by L. C. Mason

PART XL

Continued from page 792



THE OPERATION of the oil pump is extremely simple. The screwed fitting for the delivery pipe is in one with the ram, and is drilled right through axially for oil delivery. A small non-return ball valve is incorporated in the union fitting on the valve chest. The cylinder is moved to and fro over the ram by the small eccentric working in a square bottomed groove milled up the side of the cylinder. Two small holes from the undersurface of the cylinder are drilled up into the bore. Thus when the cylinder moves forward oil is pumped out down the drilled ram, and on the return stroke sufficient vacuum is created in the cylinder for it to be immediately refilled with oil when the bottom ports are uncovered at the back dead-centre position.

A bonus advantage of this arrangement is that the timing of the port uncovering can be exactly regulated by the amount by which the ram is screwed into the tank, which can be used to adjust the amount of oil delivered each stroke.

Start with machining up the cylinder. The great thing here is obviously a true and parallel bore, and to help in achieving this it is better to produce a bore right through the piece and then fit an end cover. I did all the machining on the end of a length of $\frac{3}{8}$ in. square hard brass rod.

Mark out the centre of the bore on one side of the rod and set the piece up on the vertical-slide

square in all directions. Lock every feed possible, except the saddle. Start the bore hole with a small centre drill and drill right through No. 31, following up slowly with a sharp $\frac{1}{8}$ in. reamer or D-bit. Slew the slide round to present the end of the rod to the chuck and mill the $\frac{1}{4}$ in. wide eccentric groove $\frac{3}{32}$ in. deep, feeding up and down across the cutter with the vertical-slide. A home-made slot drill does this quite happily. Part or saw off the little end block and rub the faces on a smooth flat file to clear all burrs.

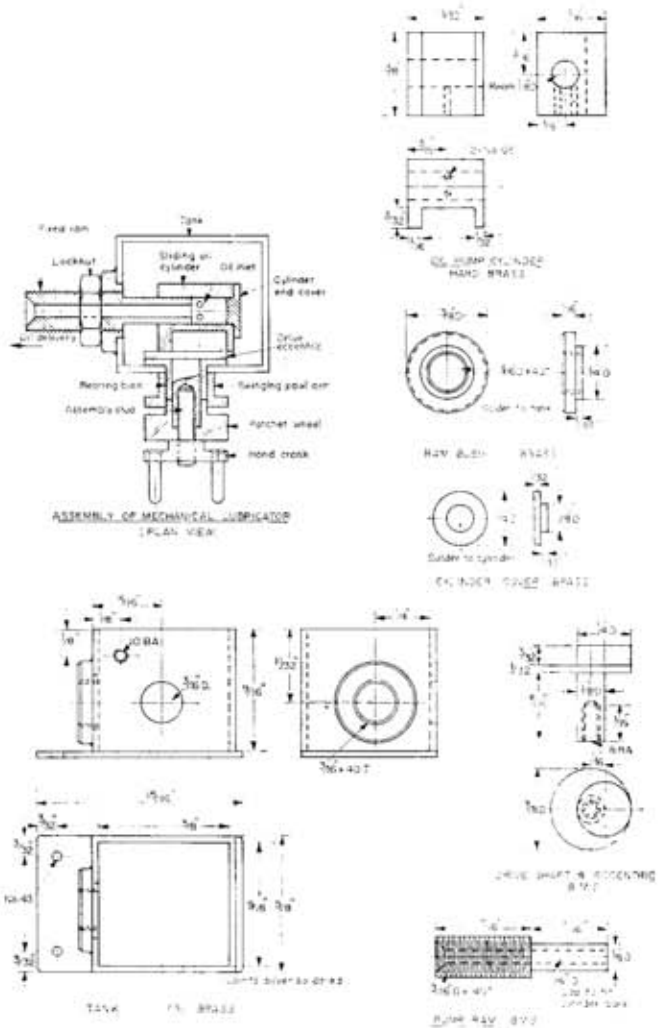
From $\frac{5}{16}$ in. A/F hexagon brass make a $\frac{3}{16}$ in. thick nut tapped $\frac{5}{16}$ in. × 40 t. Chuck a stub of $\frac{5}{16}$ in. dia. steel rod and with the tailstock chuck thread about $\frac{7}{8}$ in. length $\frac{5}{16}$ in. × 40 t, part off $\frac{3}{4}$ in. long. Make up a chucking bush tapped $\frac{5}{16}$ in. × 40 t if you have not already got one and screw in the stub of screwed rod, locking it in place with the nut so as to leave about $\frac{3}{8}$ in. protruding clear of the nut.

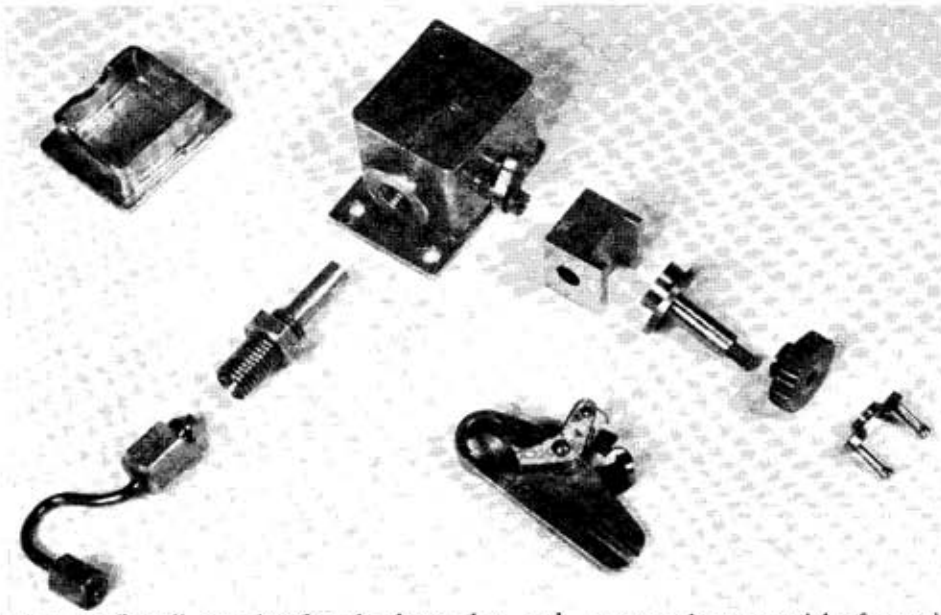
Now comes the careful bit: turn down the outer $\frac{3}{8}$ in. until it is a stiff sliding fit in the bore of the brass cylinder block. If it is a trifle too stiff, leave it at that rather than attempt to turn off any more, and either make a tiny lap from a scrap of copper and lap it down slightly freer, or gently work it freer in the block with an application of tallow. Why this dodge should work, I don't really know —but it does! Ideally it should slide smoothly with a very slight drag all along, with no tight spots. Face back the end if necessary to leave it $\frac{1}{2}$ in. long. Start the pilot end of the smallest centre drill in the faced end of the ram, and drill in $\frac{1}{16}$ in. dia. for $\frac{5}{16}$ in. or so.

Reverse the piece in the tapped bush, again locking it with the nut, leaving $\frac{1}{8}$ in. or so sticking out clear. Face this end flat also, go in with the centre drill again till the cone is nearly out to the full diameter of the piece, and follow up with the $\frac{1}{16}$ in. drill, going right through to meet the hole started from the other end.

For the eccentric, chuck a $1\frac{1}{2}$ in. length of $\frac{3}{8}$ in. steel rod and face the ends. From the machining marks on one end you can mark in a point exactly $\frac{1}{16}$ in. off centre. Centre dot this, and re-chuck in the four-jaw so that the centre dot runs quite true. Have about $\frac{3}{4}$ in. protruding from the chuck and turn this down to $\frac{1}{4}$ in. dia., to fit snugly in the milled slot in the cylinder block. Remove from the chuck and cut back the $\frac{3}{8}$ in. dia. portion to about $\frac{1}{16}$ in. long. Re-chuck in the four-jaw, gripping by the $\frac{1}{4}$ in. dia. portion and get the outer $\frac{3}{8}$ in. end running true. Face the end flat and turn down to $\frac{1}{8}$ in. dia., taking it back to leave a full $\frac{3}{8}$ in. dia. collar $\frac{3}{32}$ in. thick. Face back the $\frac{1}{8}$ in. turned down end to $\frac{5}{16}$ in. long and drill in about $\frac{1}{4}$ in. deep No. 50. Start in an 8 BA taper tap from the tailstock chuck, remove from the lathe and finish tapping 8 BA by hand to at least $\frac{5}{16}$ in. deep. Now at the long $\frac{1}{4}$ in. dia. end, cut this off to leave $\frac{1}{8}$ in. or so of $\frac{1}{4}$ in. dia., re-chuck by the $\frac{1}{8}$ in. end in the three-jaw and face back the end of the $\frac{1}{4}$ in. portion to $\frac{3}{32}$ in. long—just long enough to engage the cylinder slot fully. This sounds quite an "end-for-end" business, but it is about the best way of ensuring that each end can be held for turning.

The tank is simply made up from two pieces of $\frac{3}{32}$ in. brass—the same materials as for the tender. Cut a strip a full $\frac{5}{16}$ in. wide by some $2\frac{1}{2}$ in. long, and bend up the four sides of the tank from this. I found an odd scrap of $\frac{5}{8}$ in. square steel bar and faced back two sides to make a bending former, which gives nice sharp corners when the strip is tapped flat round it. Cut out a rectangle of the





The lubricator parts laid out; photograph is slightly over actual size.

same stuff well oversize for the base plate and silver solder the bent up sides to the bottom, wiring them in place for so doing. The join up one corner can be done at the same time. The thin 40 thou silver solder wire is the stuff here, applying it inside the box to avoid an unnecessary fillet outside. Pickle, clean up inside and out, and file the base down to size.

The eccentric runs in a tiny bronze or gunmetal bush, and the ram screws into the side of the tank through a thickening disc of brass soft-soldered on the outside of the tank. So these two pieces are next. The bush needs no detailing, except to say D-bit the bore for a close fit for the eccentric shaft. When soldering in place, the flange goes inside.

The thickening pad at the end of the tank for the ram is turned up from a stub of $\frac{3}{8}$ in. dia. brass rod. Turn the $\frac{1}{4}$ in. dia., register and drill into the rod end about $\frac{1}{8}$ in. deep with No. 20 drill before parting off. Tap the disc $\frac{5}{16} \times 40$ t square to the end of the tank after it is soldered in place.

The cylinder can now be finished off by drilling the two No. 65 holes up from the bottom face into the bore. Pass the ram gently into the bore again, which will clear off any tiny burrs left by the drilling. The end cover is merely a slice parted off from the end of a piece of $\frac{1}{4}$ in. dia. brass rod, with the little register turned a close fit in the bore of the cylinder. Sweat it securely in position on the end of the cylinder. Note that there is a right and a wrong way up for the cylinder; the thicker edge to the eccentric groove comes on the delivery side, to provide slightly more mass of metal contacting the eccentric on the heavier delivery stroke. Solder paste makes a neat job of sweating these three little items in place.

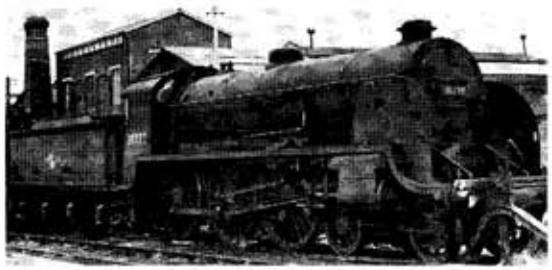
To assemble the pump, insert the eccentric through its bearing bush from inside. Drop the cylinder into the tank, locating the operating groove over the eccentric. Screw the ram through the tank end, picking up the bore of the cylinder with the ram end as you go. For maximum delivery, screw the ram in until it just fouls the cylinder cover at the full forward position of the cylinder, then back off a turn and lock with the nut outside. If you have any endfloat on the eccentric, so that the cylinder can tilt slightly, take this up with a paper washer or washer under the collar of the eccentric, between that and the bearing flange. This will act as an oil seal, as the eccentric shaft will be below oil level when the tank is full. And it will not cost much to fill!

The lid for the tank is made in exactly the same way as the body, filing any clearances as necessary in the lower edges of the lid to clear the cylinder and/or bearing bush flange.

The ratchet drive wheel is a simple turning job from $\frac{3}{8}$ in. silver steel, drilling the bore $\frac{1}{8}$ in. dia. for a bare $\frac{1}{8}$ in. deep and following up with No. 50 drill for tapping 8 BA. With either an end mill or a slot drill, bottom the $\frac{1}{8}$ in. hole out square ended, trying the protruding end of the eccentric shaft in the assembled pump in the drilled end of the rod to check that the hole is deep enough to use all the available end of the shaft sticking out of the bush.

Start to part off, but stop when the parting

Continued on page 875



ELAINE

A 2½ in. gauge "King Arthur"

by DON YOUNG

Continued from page 687

THE TOOL POINT will quickly indicate any eccentricity. A carbide-tipped tool is much to be preferred for wheel turning. Try and obtain a square ended one and have a 1/16 in. radius ground on the corner of the tip. I doubt if you will manage this on the "home" grindstone, so ask around for assistance. If I remember correctly, a green grit wheel is required for carbide tipped tools, but it is now 11 years since mine was last sharpened so I can't be sure!

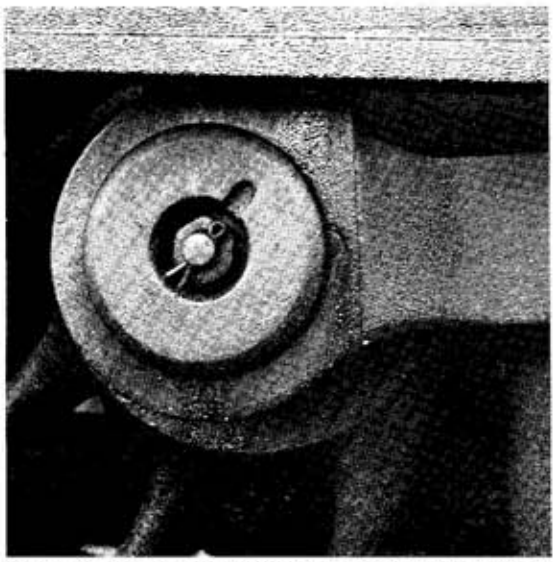
Once you possess such a tool, the rest is easy. Take a facing cut across the back of a wheel, boss and all. With the Myford ML 7, the highest back-gear speed is about right. Select the next speed down if you are unlucky enough to get chatter marks. Many wheel castings nowadays have as little as 1/16 in. *TOTAL* machining allowance on the thickness. So take care not to take too much off the back of the wheel. With a carbide-tipped tool it is easily done.

Centre and drill through the boss to 1/2 in. dia. Bore out to a few thou less than 7/16 in. dia., then finish ream. Bring all the wheels up to this state. Oh, there is one more operation that can best be done when machining the wheel backs. Turn down the wheel flange to 3 1/8 in. dia., taking care not to run the tool into the chuck jaws. With a half-round file (it fits easiest) produce a small radius between wheel back and flange.

It is very difficult to avoid repetition on several stages of construction, from engine to engine, and the following is a case in point. We now have to support the wheel on a mandrel, to machine the tread concentric with the axle hole; or we shall have an engine which goes up and down, as well as along! Obtain an old, or broken drill with the same taper as the headstock. Saw the drill off just behind the end of the flutes, yes, an ordinary hack-saw blade will do it quite easily. Clean any stray swarf out of the headstock mandrel, then tap the drill shank in with a wooden mallet. It must not work loose before all the wheels are finished. Reduce the shank, almost to the headstock mandrel, to a push fit on the wheels. If there is sufficient spigot protruding, after the faceplate is fitted and the wheel offered up, turn this down to 1/4 in. dia. and screw, BSF, BSW, or what have you, for a retaining nut. Fit a wheel and clamp to the faceplate with a couple of countersunk screws between spokes. Face across the wheel, to give a tyre thickness of 7/16 in. Remember that this time the crank boss is 1/32 in. proud; face this off too. If you use only the top and cross-slides for these machining operations, the micrometer collar readings can be taken, so that all the wheels are identical. Now, concentrate on the wheel tread and turn it down to a full 3 1/8 in. dia. The tool radius will give a nice blend between tread and flange. Produce a small radius on the top corner of the flange, just like at the back. Again get all the wheels up to this stage. Now, take a final fine cut across the tread of the last wheel. Leave the tool setting and repeat on the remaining wheels, when they will all be of the same diameter. To finish the tread, mount each wheel in turn and cut the 30 deg. chamfer at the outside, with either the carbide-tipped tool or a smooth file. The latter is easiest and avoids the possibility of tool chatter. To finish the wheels, the crankpin holes must be drilled. For this a simple drill jig is required.

The purpose of the jig is to ensure that all the crankpins are of equal throw, so the wheels don't bind up solid when the side rods are put on. In 2½ in. gauge, every effort has to be made to reduce internal losses, so that the maximum possible pull is available at the drawbar. Using this philosophy to the full, the axle-driven feed pump has been dispensed with and two injectors fitted in lieu. To tackle the design in this manner means that the boiler has got to be a good steam producer.

Saw a 1¼ in. length from 3/4 in. × 1/4 in. b.m.s. flat. Scribe on a centre line and centre pop 3/8 in. along it from one end. At 5/8 in. from the first pop mark, ditto repeato. Be careful to keep this dimension very close to 5/8 in., if made overlong the piston heads may hit the end covers. Too short and valuable power will be lost: you have been warned. These holes must be produced, either in the lathe, using a drill pad in the tailstock, or in the drilling machine. Drill first No. 13 and then ream both holes 7/16 in. dia. Next, chuck a length of 3/8 in. bar, steel or brass, in the three-jaw and reduce for 1/4 in. length to a press fit in the hole at 3/8 in. from one end of the flat bar. Turn down the next 3/8 in. or so to a nice tight sliding fit in the wheel boss, that is 7/16 in. dia.



Study in Oil. Leading Crankpin; note the recess in the retaining cap for fitting the split pin.

Part off to $\frac{5}{8}$ in. overall. Press the spigot into the correct hole and the jig is complete. Turning press and sliding fits will be good exercise for the axles, of which more in a moment.

Fit the drill jig onto the front of a wheel. Use a clamp to make sure it cannot move. With a $\frac{1}{16}$ in. drill, make a light pop mark on the wheel. Check that this mark is nice and central on the crank boss, before going any further. If not almost perfectly central, the result will look horrible. When satisfied, deepen the pop mark, then machine drill, just as for the jig, No. 13 through the wheel, followed by the $\frac{1}{8}$ in. reamer. Finish all the wheels in like manner.

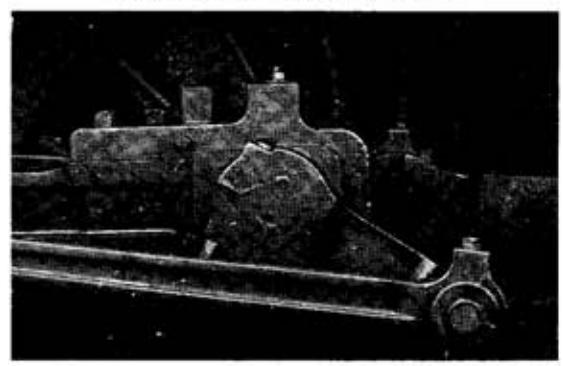
Crankpins come next in order, the preference here must be for silver steel. Any beginner who finds he cannot master the art of machining silver steel can always revert to mild steel as an alternative. For the leading pins, chuck a length of $\frac{3}{32}$ in. dia. silver steel in the three-jaw and reduce for $\frac{1}{32}$ in. length to a press fit in the wheels. Part off at $\frac{17}{32}$ in. overall, reverse in the chuck, drill No. 48 for about $\frac{5}{32}$ in. point depth and tap 7 BA. Oh, I have been gaily mentioning press fits, without explaining how to get them. The intention was to leave this part of the description until the axles, but it can't be delayed that long. So let us apply the technique to the driving pins. Chuck the $\frac{3}{32}$ in. rod again and turn down for $\frac{11}{32}$ in. length to about .192 in. dia., using a micrometer to check. Carry on reducing the outer $\frac{1}{16}$ in. length to a push fit in the wheel. Note the cross-slide "mike" collar reading, wind back, say, 30 divisions, to take up any slack in the feed screw nut. Now, advance again to within half division of the previous setting. Take a cut right along the spigot at this setting, when the result should be a perfect press fit. It does not always pan out at the first attempt. Each lathe seems to obey its own law, but once you have the job mastered, press fits can be repeated until further orders. If the first result is a dismal failure, just part the spigot off and try again; only $\frac{1}{32}$ in. of bar is lost in the process. Part these pair of pins off to $\frac{31}{32}$ in. overall.

Before we can finish the driving pins a simple gauge is required. Chuck a length of $\frac{1}{4}$ in. dia. brass bar in the three-jaw. Face, centre, drill No. 24 for about $\frac{3}{8}$ in. depth and ream to $\frac{5}{32}$ in. dia. Part off a $\frac{1}{16}$ in. thick slice, which is the gauge. Reverse the driving crankpins in the chuck and reduce the outer end for $\frac{5}{32}$ in. length, to a nice push fit on the gauge just produced. Now the return crank will behave itself when fitted, later on.

The trailing crankpins are next in line for treatment; for these $\frac{1}{16}$ in. dia. rod should suffice. Just ease off the end, with a fine file, to check that the pin will be a press fit in the wheel. If your luck is out, revert to the $\frac{3}{32}$ in. rod and proceed as before. Whichever method has to be adopted, part off to an overall length of $\frac{31}{32}$ in. Reverse in the chuck, reduce for $\frac{5}{32}$ in. length to .142 in. dia. and screw 4 BA. All that remains is to fit the pins; a fairly tricky exercise if you don't want to spoil them and/or the wheels. Adopting the following procedure will take the bugs out.

Trailing crankpins first. Fit a 4 BA brass nut on the vulnerable threads and enter the pin into the wheel. Give it a couple of taps with a soft faced mallet and check it is entering squarely. If all is well, bring the soft vice jaws into service and start pressing the pin into the wheel. If the job becomes a life and death struggle, stop, and press the pin out again. To do this easily, chuck a length of $\frac{3}{8}$ in. brass rod in the four-jaw. Face, centre and drill No. 9 for $\frac{13}{16}$ in. depth. Part off to $\frac{3}{4}$ in. over-

Driving pin and associated parts of "Sir Balin." Square pin end can just be seen.

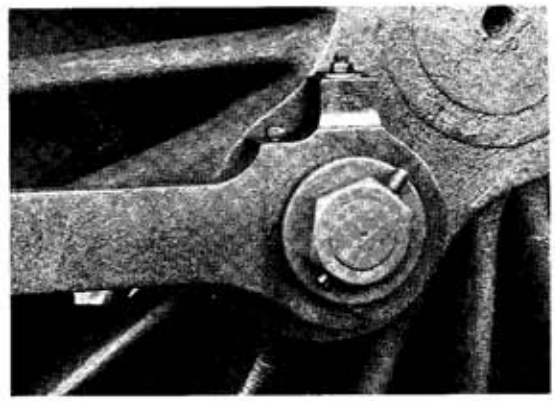


all. Place this piece over the offending pin. The other piece required is a $\frac{3}{8}$ in. length of $\frac{7}{16}$ in. dia. brass rod, an easy sliding fit in the wheel hole. Most brass rod is slightly undersize, so you probably won't even have to machine it to get the correct fit. Assemble this little driving rod into the back of the wheel, when the crankpin can be pressed out quite readily.

Chuck the offending pin in the three-jaw, run the lathe at top speed and apply a piece of emery cloth, to remove those odd 1/10 of a thou which are causing all the trouble. It takes very little to effect the cure, so don't take too much off. Press these pins home. The same technique applies to the driving crankpins, only this time use the little brass gauge to protect the fragile, return crank, end.

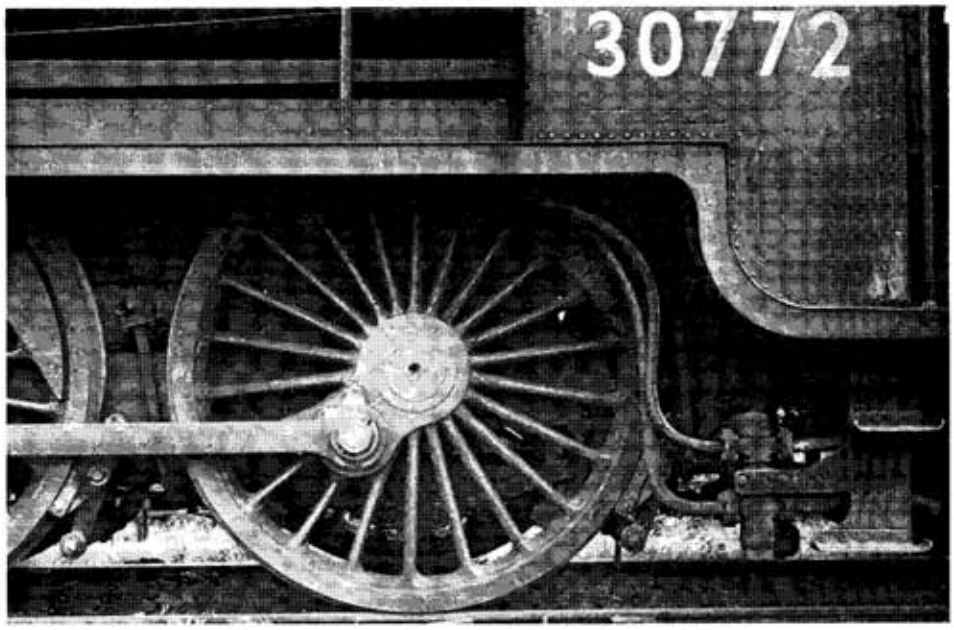
For the leading crankpin, a protecting cap is required. Chuck the $\frac{3}{8}$ in. brass bar; face, centre and drill No. 3 to $\frac{5}{32}$ in. point depth. D-bit to $\frac{7}{32}$ in. dia. before parting off to about $\frac{1}{4}$ in. overall. Put this cap over the crankpin end, when it can be pressed home without damage. Not too difficult, was it!

Turning up the axles will now be a piece of cake. Chuck the axle material in the three-jaw and check with a dial test indicator that it is running perfectly true, or within .0005 in. ($\frac{1}{2}$ thou). If this is not the case, revert to the four-jaw and set to run true. Face the axle end, then turn down for $\frac{11}{16}$ in. length to a press fit in the $\frac{7}{16}$ in. wheel boss. Centre the axle end, Slocombe No. 3, for appearances' sake, then part off to $2\frac{31}{32}$ in. overall. Reverse in the chuck, set to run true and repeat the process for the second wheel seat. Press one wheel onto each axle, it is only a larger version of crankpin fitting, but don't fit the second wheels for a while.

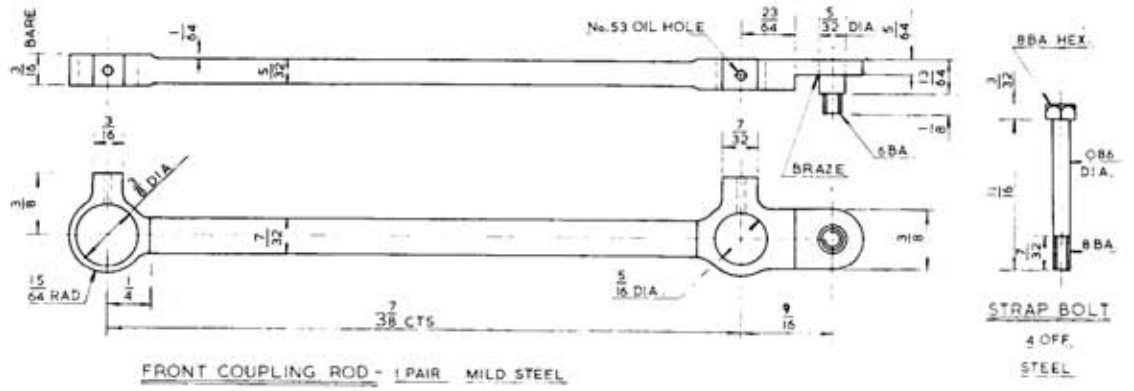


Coupling and connecting rods

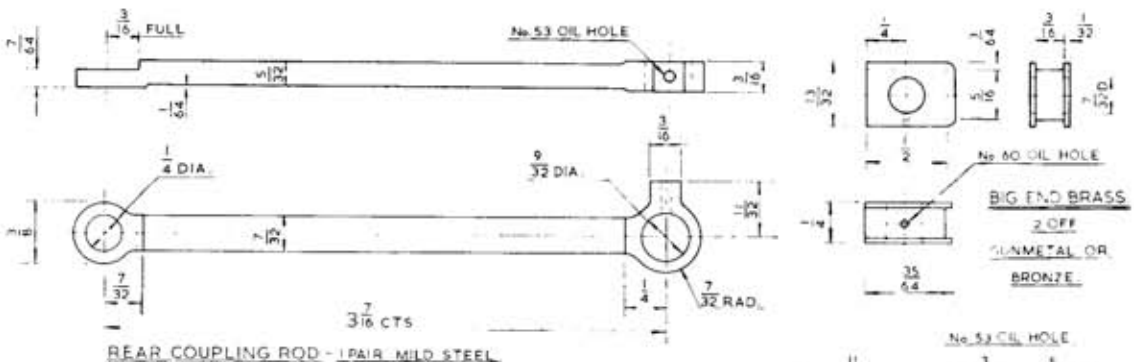
Many gadgets have been " invented " for quartering wheels, to exactly 90 deg. For such a simple engine as *Elaine*, or *Sir Ironside*, undoubtably is, no gadgets will be necessary. The cranks can be at 85 deg. or 90 deg. to each other and nothing will be amiss. All it does mean is that the exhaust beats will be slightly syncopated, so slight that the effect won't be detectable. If you happen to get a syncopated exhaust it is more likely to be the fault of incorrect valve setting. As a matter of fact, on *Mallard*, due to her three cylinders, the cranks are set 120 deg. apart. (*Actually 120 deg.—126 deg.—114 deg.—Ed.*) Yet she managed 126 m.p.h. and would have gone much faster, given the chance. It



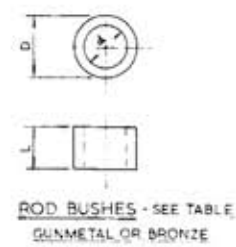
Trailing coupled wheel on No. 30772. The retaining cap is secured by the large taper pin seen in close-up, top right. Builders should aim to improve on that pipework to the injector!



FRONT COUPLING ROD - 1 PAIR MILD STEEL



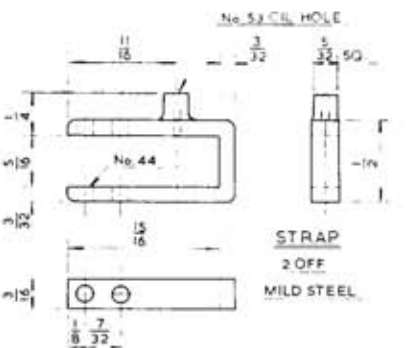
REAR COUPLING ROD - 1 PAIR MILD STEEL

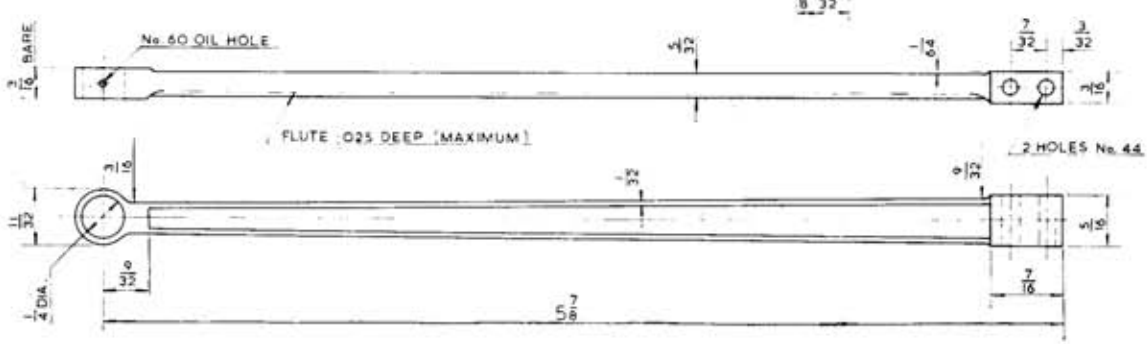


ROD BUSHES - SEE TABLE
GUNMETAL OR BRONZE

COUPLING RODS	D DIA	d DIA	'L'	No.OFF
LEADING	3/8	7/32	3/16	2
DRIVING	3/16	7/32	3/16 FULL	2
KNUCKLE	1/2	5/32	1/8	2
TRAILING	9/32	3/16	3/16 FULL	2

CONNECTING ROD	D DIA	d DIA	'L'	No.OFF
CROSSHEAD	1/4	3/16	3/16 FULL	2





CONNECTING ROD - 1 PAIR (OIL HOLE ONLY HANDED) MILD STEEL

is not beyond the realms of possibility that an A.4 has exceeded this speed in service. LBSC told in one of his lobby chats how a "Minx" had managed 82 m.p.h. on a special excursion. Her driver got two weeks suspension for his efforts. On the Isle of Wight, yours truly timed an 0.2 up to 75 m.p.h., my most hair-raising experience ever. Nobody reported the driver on this occasion, but he did not survive much longer. His sentence was permanent withdrawal from the footplate. Yours truly will suffer the same fate if he does not get on with the job in hand.

As has already been said, it does not matter if the cranks are not exactly at 90 deg.; what is important is that all three sets are at exactly the same angle. To ensure this we must first make the coupling rods, starting with the front pair. Mark out, on a 5 in. length of $\frac{3}{4}$ in. × $\frac{5}{16}$ in. b.m.s. flat, the correct profile. Drill and ream, or use a $\frac{3}{8}$ in. end mill, to produce the hole for the front bush. This hole must be perfectly square through the rod, so use either the lathe or drilling machine. Next we require some "aids to manufacture." The first piece is a $\frac{3}{4}$ in. length of brass rod, nominally $\frac{3}{8}$ in. dia., a push fit in the leading axleboxes and the hole just drilled in the embryo coupling rods. This had better be made from $\frac{1}{2}$ in. bar, to get the required fit. Chuck the brass rod again and turn down for $\frac{5}{16}$ in. length to a push fit in the driving axleboxes. Face, centre and drill to $\frac{5}{16}$ in. dia. to a full $\frac{5}{16}$ in. depth. Part off at $\frac{1}{2}$ in. overall. Produce a similar bush for the trailing boxes, this time drilled to $\frac{5}{32}$ in. dia.

Fit pieces of packing between the top of each box and horn, to wedge them firmly down onto the hornstay plates. Fit the drill bush, just made, to one of the driving axleboxes. Insert the brass rod into the leading box on the same side and position the coupling rod over it. Line up the rod and the driving box, so that the marked out hole centre coincides with the drill bush hole. Clamp the rod firmly in this position. Spot through the bush, from the other frame, $\frac{5}{16}$ in. dia., as a check, then set up in the drilling machine or lathe, to drill right through the rod to $\frac{5}{16}$ in. dia. The axle centres now coincide with the rod centres. Mark which side this rod is, as the centre distance could vary by a few thou on the other side, enough to spoil the job. Repeat for the other leading rod.

Saw out the profile roughly to the marked lines, then machine drill the $\frac{5}{32}$ in. dia. hole for the fork joint pin. Make it No. 23 if you like, so the pin is a press fit. The bosses must next be radiused; to do this a traditional set-up is necessary. First grip a length of $\frac{5}{32}$ in. dia. in the machine vice, on the vertical-slide. A little semi-circular recess in the top jaw of the Myford machine vice makes this job easy. Chuck an end mill, about $\frac{1}{4}$ in. dia., in the three-jaw; fit the fork end of the rod over the silver steel spigot and mill the rod to a neat semi-circle. Take light cuts and grasping the other end of the rod firmly with the hand—it's quite safe—pull the job around the cutter. Repeat the dose on the driving and leading bosses, gripping the correct size rod in the machine vice. Be careful you do not remove the oilboxes when milling, it's easily done! Mill or file the rest of the rod profile to the scribed lines.

Remove the machine vice from the vertical-slide and replace with an angle plate. Set this up level, one of the edges of the angle plate should be machined to make this a simple task. Simply stand a piece of flat bar on the lathe bed and bring the vertical-slide down until the angle plate sits on the top edge of the bar. Tighten up the angle plate. Bolt a rod to the top face of the angle plate; $\frac{1}{4}$ in. countersunk screws are best, the heads locate nicely in the coupling rod holes. Chuck a side and face cutter in the three-jaw, for preference one about $1\frac{1}{2}$ in. dia. with its own spigot, and machine the 1/64 in. reliefs on both sides of the rod. End milling the top and bottom faces of the rod can be carried out at this set-up if desired. Set up the machine vice again, grip the rod as close to the driving boss as you can get and mill the 5/64 in. thick tongue at the fork end. Clean off all the burrs produced by the machining, at the same time reducing the leading boss thickness by a few thou, to a bare $\frac{5}{16}$ in. Drill the No. 53 oil holes, then make up the fork end pin, just like the trailing crankpin. Braze it in, dropping into water as soon as the rod glow disappears, then the pin will remain fairly hard. The rod will have bowed slightly under the treatment. Fit a $\frac{5}{16}$ in. silver steel pin in the driving box drill bush and carefully bend the rod until it slides over both the leading and driving axlebox spigots.

Polish up the finished rods with fine grade emery cloth and coat liberally with oil and we can move quickly on to the trailing rods. Mark out the profile, then drill the $\frac{1}{4}$ in. dia. fork end hole. Chuck a length of $\frac{5}{16}$ in. dia., or larger, bronze or gunmetal rod in the three-jaw. Face, centre and turn down for $\frac{1}{8}$ in. length to a press fit in the rod. Drill No. 22 to $\frac{5}{16}$ in. depth, then part off at 7/64 in. overall. Press into the outside of the rod, it will not go right through. Grip the rod in the machine vice and machine the mating fork end tongues to 7/64 in. thickness. Fit to the leading rod, to check that the fork ends are not binding. Level up to the trailing box, with the drill bush already fitted, and repeat the drilling operation as for the driving box. The rod profiling, etc., is as for the leading rod, so I will refrain from unnecessary repetition.

(To be continued)

CAMELBACKS
and early American Locomotives
by Conrad Milster

THE EARLIEST CAMELS built from June 1848 on (not 1844 as Jeynes says on page 774, August 2, 1968) had an extended firebox with a "step" in the upper part (see sketch) and had about 16½ sq. ft. of grate area. The joint between the firebox and boiler shell was a highly stressed one as it supported firebox, fuel on the grates and water and in order to remove as much weight as possible from the back of the engine the cab and engineer were placed on top of the boiler while the fireman was moved back to the tender, thus eliminating the weight of the footplate. Another weight saving device was elimination of the water leg at the back of the firebox and substitution of a dry back, certainly a doubtful move as far as efficiency was concerned. By having the 0-8-0 style of engine, Winans was able to keep his wheelbase down to 11 ft. 3 in., an important consideration in view of the many sharp curves in use at the time. This with 43 in. dia. drivers and 17 in. × 22 in. cylinders.

Winans developed his engine into a "standard" type and typical dimensions for the first series included: boiler dia. 41 in. made of $\frac{7}{16}$ in. plate, containing 101 tubes of iron 2½ in. dia. × 13 ft. long, grates were 56½ in. long × 42½ in. wide and the boiler was fitted with a large steam dome 41 in. dia. × 51 in. high placed in the forward part of the cab.

In about 1850 or shortly thereafter, Winans adopted the slope-backed firebox which had been developed a few years earlier by Isaac Drips in 1848. This series of engines was known as the "medium furnace" size and was very similar to the earlier class. One change was an increase in cylinder bore from 17 in. to 19 in. There was a slight increase in boiler diameter and grate sizes were about 80 in. long × 42 in. wide. Tubes remained at 101 but were reduced to 2¼ in. dia. while increased to 14 ft. in length. This class of engine, with Winans' rather odd stack design, is illustrated in Jeynes' Corner, page 774, August 2, 1968. Winans did not believe that a fireman would properly fire the long grates and so he provided two coal hoppers on top of the firebox, but as the fireman had to handle the coal twice, once to the upper tender platform, then into the hopper, I wonder if this method was any more popular than attempting to fire through the regular firedoor. This, combined with the large cylinders and absence of lagging on cylinders, boiler or firebox must have made these engines hard steamers. Normal speed for a camel was only 10 to 15 m.p.h. which was probably a blessing for the fireman.

The lack of lagging exhibits a rather strange aspect of Winans' character, as if his entire camel design was planned to flaunt his contrariness in the face of the railroading world. Consider also his lack of leading wheels which would have improved the tracking qualities of the engine, placement of the feed pump on the outside sheet of the firebox, its lack of an air dome and the pump discharge

Fig. 1: No. 592 shows the width of her firebox, also the fireman's gangway. One can picture him inching along this at 60 m.p.h. and realise why he ended up on the back end.

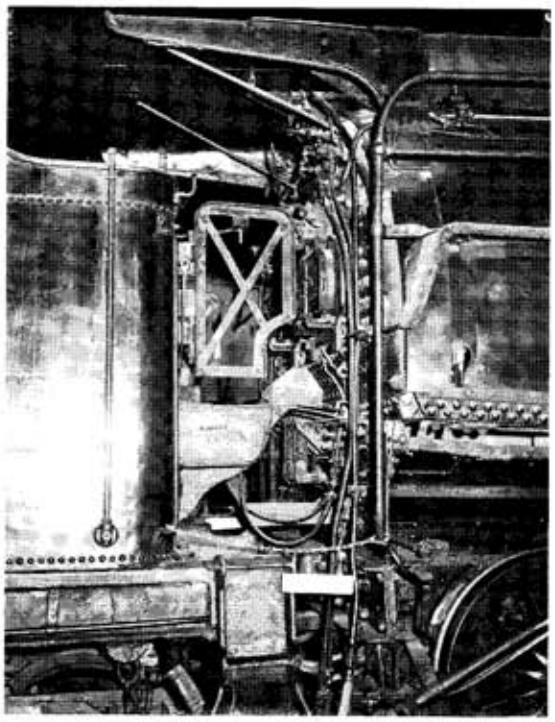


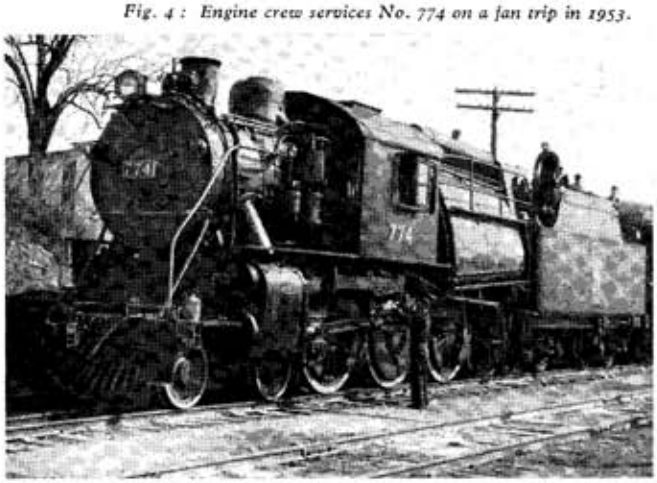
Fig. 2: Backhead of No. 592 in the B. & O. Museum. This view shows how high the firing level was. Firedoor is visible by the gangway gate. The gate seems poor protection for the fireman.

Fig. 3: Ten-wheeler No. 753 of the CRR OF N.J. waits for Monday morning commutor rush. Note that the engineer gained access to the cab from the front.

into the front of the firebox, all contrary to what was standard practice at the time. In addition, the feed pump was crosshead driven, requiring a long rod connecting the two. So long, in fact, that it ran through guides connected to the engine frame to support it.

In 1856-57 Winans developed his third class of engine and once again lengthened the firebox, this time giving a grate 42 in. wide × 8 ft. 2 in. long! This was asking a little too much of the boiler shell—furnace joint and engines of this class were very soon rebuilt into the medium furnace type. Some photographs of long furnace engines show only one chute mounted above the firebox at the boiler end, indicating, I would think, that this method was not used for coaling the near end of the grate enough to make the extra construction worthwhile.

Fig. 4: Engine crew services No. 774 on a fan trip in 1953.



The camel valve gear was also interesting and it was of the drop hook type driving slide valves of the normal style, but using three hooks per valve, one for forward, one for back, and one for cutoff. The cutoff motion was actually a cam rather than an eccentric and was only usable in forward motion. It cut off at ½ stroke and it gave the valve an intermittent motion. A horizontal shaft just under the hooks was so arranged that cams mounted on it allowed only one hook at a time to engage with the pin on the valve gear below the hooks as this shaft was rotated. Rotation was accomplished by a gear segment mounted on the bottom of the reverse lever which meshed with a spur gear mounted on the cam shaft. This lever is also clearly shown on the illustration on page 774.

The second lever coming up into the cab and a similar one mounted on the opposite side would be used to move the valve linkage for each cylinder if the hook did not line up with the pin. The bottom ends of these "starting" levers fitted into sockets from which they could be withdrawn once the engine started to move. The thought of one of these snapping back and forth alongside the engineer as the engine ran was not too cheerful a one for the engineer. This seems to be a rather clumsy gear as no tapered jaws were fitted to the end of the hook to guide it over the pin. Frequent reversing of directions, such as when switching, must have been quite tedious with this type of gear. The cabs of these early camels were quite large; enough so that the engineer could cross over from one side to the other, and they were usually fitted with huge—for the time—glazed sliding windows. These were probably added while the

engines were in service for most early photographs show open frames with canvas storm curtains for foul weather. Without any lagging on the boiler, the engineer could use all the fresh air he could get in the summer.

By present standards the camelback was an odd engine indeed, but we should remember that this was the era of glorious experimentation and this may help explain their acceptance. The fact that Winans was a heavy stockholder in the B. & O., and therefore undoubtedly had the ear of the management, probably accounts for the large number of engines he supplied to that road. His connection with the B. & O. went back to 1831.

Ross Winans was a dealer in horses who came down to Baltimore from New Jersey to sell horses to the B. & O., but became interested in steam horsepower instead. He is credited by Larry Sagle in "B. & O. Power" with helping Peter Cooper assemble the *Tom Thumb* in 1829.

In 1831 he was appointed assistant engineer of machinery and worked with Phineas Davis who developed and built the famous "grasshoppers" which were the B. & O.'s first steam engines. After Davis was accidently killed in 1835, Winans in partnership with George Gillingham took over the "Davis and Gartner" locomotive building plant until 1843 when Winans built his own shops adjacent to the B. & O. Mount Clare shop.

It is also interesting to note that Winans was instrumental in forcing the resignation of Samuel Hayes, the B. & O.'s Master Mechanic, in 1856 after a controversy reputedly over a delivery of camels. The fact that Hayes himself built some camelbacks of 4-6-0 wheel arrangement would seem to indicate that he was in favour of Winans' general ideas, but attempted to correct some of the basic design faults.

The Hayes camels were built by four different firms during 1853 and 1854, three by the B. & O.,

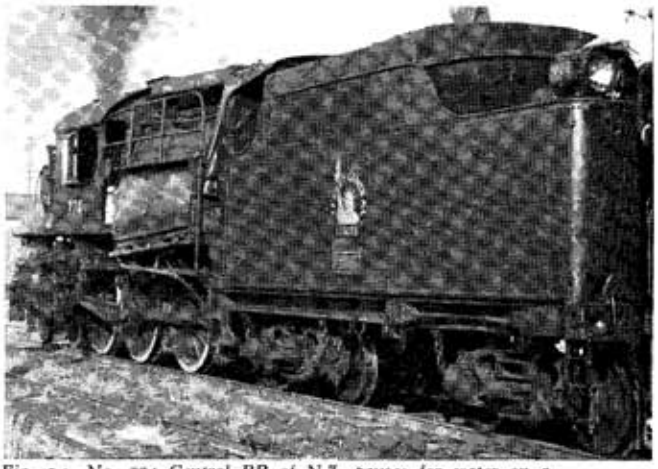


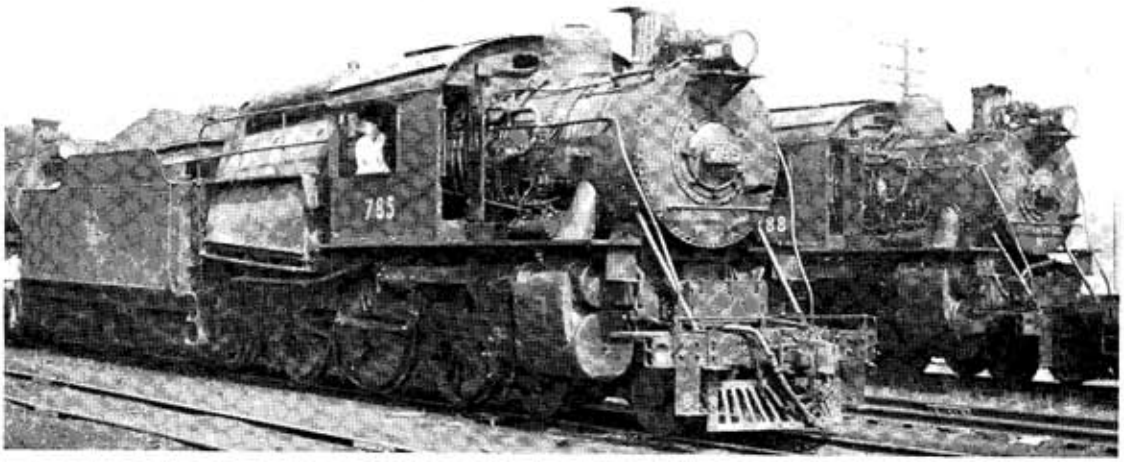
Fig. 5: No. 774 Central RR of N.J. pauses for water on a fan trip in 1953.

one by the New Castle Mfg. Co., two by Smith and Perkins and 11 by Denmeade and Co., for a total of 17. Most were retired by the late 1870's or early 1880's although two, Nos. 139 and 166 lasted till 1897. Engine cylinders were 19 in. × 20 in. with 50 in. dia. driving wheels.

These engines were fitted with the normal type of hook gear of the riding cut-off type and had both a main and separate cut-off valve on each cylinder. The cut-off valve was driven by a separate eccentric. When the cut-off gear was unhooked from the valve gear it was hooked over a pin mounted on the boiler shell to hold it in the open position. These engines were reputed to be successful engines, something which Winans' design never quite achieved, so much so that in the 1870's J. C. Davis, the Master Mechanic, built another batch of 10-wheelers in the B. & O.'s shop at Mount Clair.

The Hayes' camels used the "step" firebox which

Fig. 6: CRR OF N.J. No. 785 waiting for Monday morning passenger service to begin.



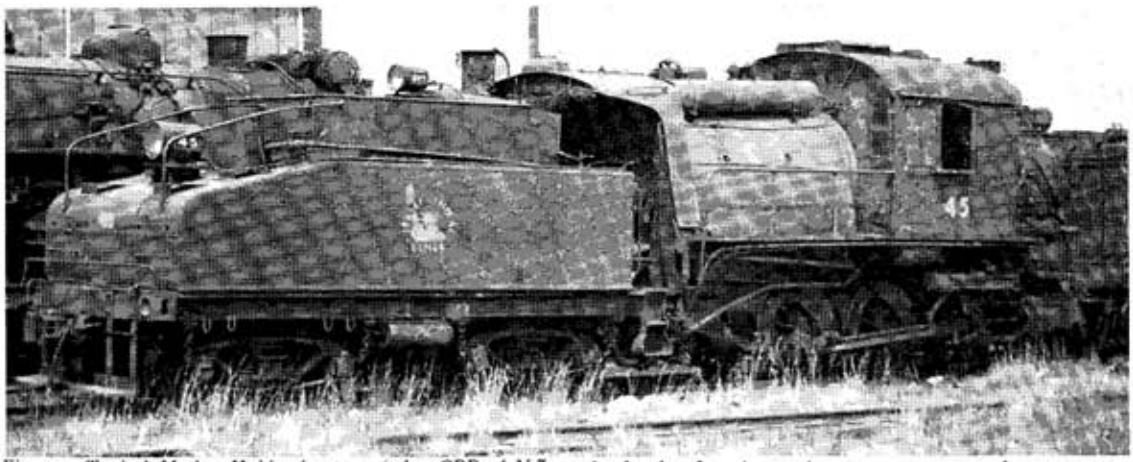


Fig. 7 : Typical Mother Hubbard type switcher CRR of N.J. 0-6-0 No. 45. The engine has inside valves with outside valve gear.

Winans first used but the Davis series used the "medium" or sloped firebox design. Photographs of camels in service show many minor modifications among which were replacement of the feed pumps with a shorter stroke pump driven from a return crank on the last driving wheel, re-routing of the delivery pipe forward to the boiler shell, and in some cases replacement of the pumps with injectors. At least one camel, possibly more, was rebuilt using a conventional type of locomotive firebox. The odd Winans' stack was usually soon replaced with a "diamond" or balloon stack of better efficiency. The original camels had no pilots but were equipped with a huge wooden pilot beam, and often a primitive type of non-sprung buffer also of wood for use when the engines were used as pushers at the back of trains going over steep grades.

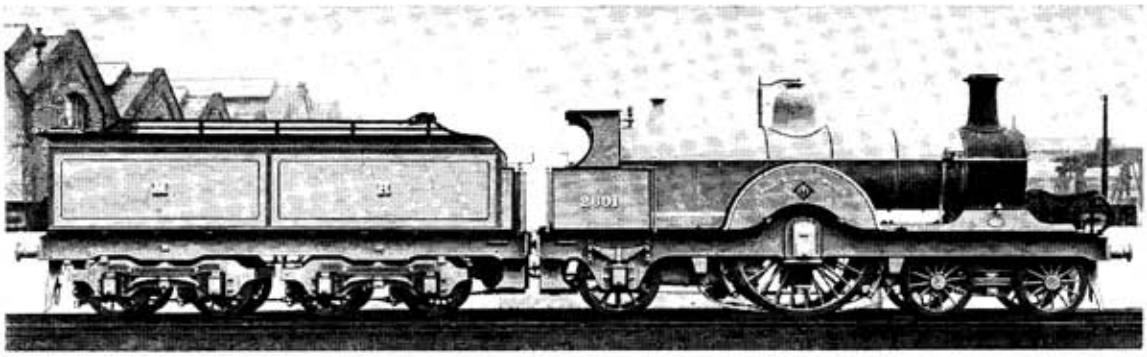
Fig. 8 : Smithsonian's Tom Thumb model, believed to be as the original. Many points disagree with the present operating replica built in 1926.

Camels as built by other builders were usually designed for higher speeds and passenger service and were fitted with the long pointed "cow catcher" which was such a prominent part of locomotives of this era. A long iron bar, pivoted on and fastened to the pilot beam, lay down the middle of the pilot and when lifted up could be used to couple cars to the front of the engine. American rolling stock at this time was all equipped with link and pin couplers.

Winans was of course not the only builder working along these lines; a number of his contemporaries such as Colburn, Milholland and Hayes were using similar ideas in their designs as pointed out by both Messrs. Jeynes and Fox in *Model Engineer*.

A most interesting engine added to the B. & O. roster in 1863 was an experimental version of the 0-8-0 camel to adapt it to passenger service. Winans built this machine in 1855 using standard camel parts but added a 4-wheel leading truck resulting in a 4-8-0. One drawing by Charles B. Chaney shows the cab mounted on the front of the engine on an extension of the frames. Unfortunately very little is known of this engine. Having the boiler, cylinders (22 in. × 22 in., slightly larger than standard) and wheels of a camel, this engine was not very successful and was undoubtedly purchased only through desperation as by then the effects of the Civil War had drastically thinned out the railroad's roster of motive power and engine builders were delivering most new locomotives to the government. An 1861 roster lists 236 locomotives (with some 19 out of service for various reasons). By 1862 the railroad had lost 57 engines in one campaign alone, with 14 stolen and dragged about 50 miles overland and then taken south, and the rest stripped or burned. At one point only 68 serviceable engines were in the B. & O.'s hands due to rebel actions.

To be continued.



PRINCESS OF WALES

5 in. gauge Midland "Single," described by Martin Evans

Part III

Continued from page 808

THE MAIN HORNBLOCKS for *Princess of Wales* are quite different from the type to which we are accustomed, as the axleboxes bear partly against the edge of the frames and partly against the horns. In some ways, this makes for an easier machining job, as the inside frames and the inside horns can both be finished to exact size before the horns are riveted to the frames, avoiding that tricky set up in the lathe.

It should not be difficult to line the horns up with the gaps in the frames if a gauge, made of a slice of bright mild steel 1½ in. wide, is clamped in position while drilling the holes. For machining the hornblocks on the lathe, the vertical-slide should be set up facing the headstock, exactly square to the lathe centre-line (use the faceplate for checking) and the horns are then clamped to the slide. The clamp can be nothing more than a 1½ in. length of ¾ in. × ¼ in. b.m.s. with an Allen screw through the middle. Machine the back face first, that is the face that goes against the frame, using an end mill about ½ in. dia., working the end mill around the ends of the clamping bar to remove as much metal as possible. Remove the hornblock from the slide and carefully file away the two high spots that were covered by the clamping bar.

Now clamp the hornblocks to the vertical-slide the other way round, using two clamps on the back flange this time, so as to leave the face of the casting clear for the end mill. Machine right across until the hornblock is exactly ⅞ in. thick.

The next operation is to machine the base, at right-angles to the sides of the casting, which should have been previously filed true. This is best done by holding the horns in the machine vice clamped to the vertical-slide, and is one of those operations which takes far less time than setting up the vice. Finally, the horns are once again clamped to the vertical-slide, but this time with a spacing piece of flat b.m.s. or brass about ⅛ in. thick, so that the end mill—which should now be about ¾ in. dia.—can run right through to machine the working surfaces. Use the 1¾ in. thick gauge here, to get a good fit.

Drill the hornblocks No. 41, clamp them to the inside frames as described previously, run the drill through, remove all burrs, and rivet up, using ⅝ in. snaphead iron rivets.

Now take the outside frames in hand, the horn slots in which, it will be recalled, were left slightly undersize. Clamp each in turn to its neighbouring inside frame, lining them up carefully at the ends, then trim the horn slots until the axlebox gauge can just be pushed in. Separate the frames, fit the outside horns in the same way, keeping the gauge in place while riveting and then carry out a trial assembly. To ensure that the axleboxes, when fitted, will all be exactly in line, obtain a true rectangular bar, 1¾ in. wide and as thick as possible (between ¾ in. and ⅞ in.) and lay this right across all four frame plates, while offering up the frames against their respective fixing angles—which should now be finally attached to the buffer and drag beams.

When everything looks right, bolt up the inside frames tightly, but remove the outside frames once more, while the various stretchers are made. The stretchers that lie between the inside frames consist of three items, the motion plate, the main stretcher and a plain thick bar-type stretcher at the rear. The motion plate is somewhat complicated and I think it best to leave this until after the cylinders have been made. The main stretcher is a casting, iron or gunmetal as preferred and calls for no com-

ment. I prefer to file the outside edges first, getting the ends reasonably square to the sides, then to chuck the casting in the four-jaw, flat plate about ¼ in. thick being put between the front and back faces to give something for two of the four jaws of the chuck to grip on. A light cut is then taken right across one of the bolting faces, the casting reversed in the chuck, carefully lined up and a final cut taken to bring the stretcher to a width of exactly 4¼ in. The rear stretcher is just a hefty slab of bright mild steel, machined in the four-jaw, or an iron casting can be used.

The stretchers between the inside and outside frames consist of a plain one shaped rather like a lathe "tee-nut," made from an iron or gunmetal casting, and two hollow ones, which act as front and rear sandboxes. They should all be carefully machined to a thickness of 1⅛ in.—the distance between the two frames. The sandbox-stretchers are bored out from the top (after the outsides have been machined to size) to a diameter of ⅝ in., and they are then drilled up from underneath ¼ in. dia. followed by letter J drill for a depth of ½ in., this being tapped 5/16 in. × 32T. The top is covered by a 5/16 in. brass plate, held down by four 8 BA brass countersunk screws. A sand filling plug will be fitted to this plate later on.

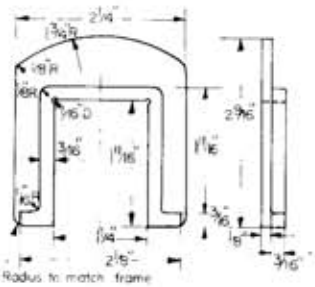
The No. 30 holes for bolting these stretchers to the inside frames should now be drilled, and after the castings have been correctly located on the inside frames, the drill can be run through these holes to make deep countersinks, which are then drilled and tapped 5 BA. The screws used to hold these stretchers should be just a shade over 5/16 in. long, so that they only just protrude through the frames.

Trial assembly

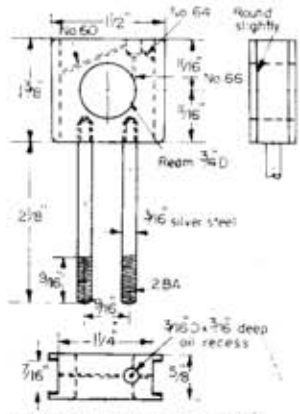
Bolt all the stretchers so far made in position, set up the 1¾ in. bar through the horns once again, and align the outside frames correctly. The No. 34 drill can now be put through the holes at the ends of the outside frames, and the No. 43 through the holes opposite the stretchers, tapping 6 BA and 8 BA respectively. At this stage a trial assembly can be made, using steel cheesehead screws for convenience, but the outside frames have to come off once again, for the fitting of the steps, trailing springs and horns and the little handrail by the steps.

Axleboxes

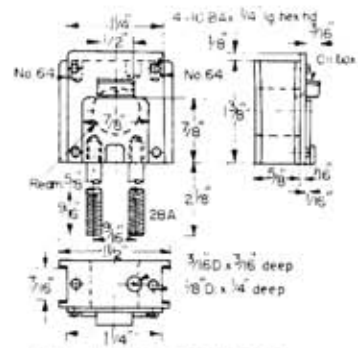
There is a distinct difference between the inside and the outside axleboxes. The former are ¾ in. bore, while the latter are only ⅝ in. bore, and have a cover plate bolted on the outside with an oilbox, etc. They can both be made from castings, either iron or gunmetal as preferred, or they can be built up from bright mild steel sections. I have just made a set of four 5 in. gauge driving axleboxes, using 1¾ in. × ½ in. b.m.s. bar, with separate flanges cut from 1½ in. × ⅜ in. b.m.s. The flanges were screwed on with 6 BA countersunk steel screws. The whole was bored in the lathe (actually before the second flange was attached) and a Lubrook oil-retaining bush fitted. I was very pleased with the result and can recommend the construction to anyone who is shaken by the present high price of gunmetal castings! Incidentally, there is a point to watch in fitting these Lubrook bushes. As purchased, it will be found that they are quite a slack fit on the axle, assuming this to be of the correct nominal diameter to the nearest ½ thou. The hole bored in the axlebox must be at least 1½ thou undersize, and after pressing the bush home (they go in quite easily even with this interference due to their oily surface), it will be found that they are a nice working fit on their axles.



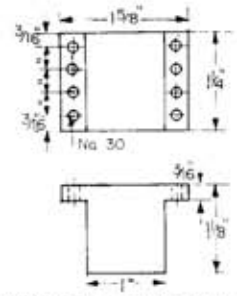
MAIN HORN BLOCK 4 OFF
GUNMETAL CASTING



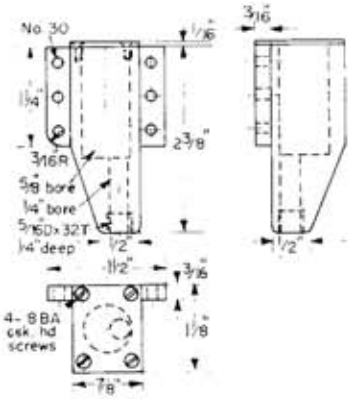
MAIN AXLE BOX INSIDE 2 OFF
G.M. CASTING OR B.M.S. WITH
LUBROOK BUSH



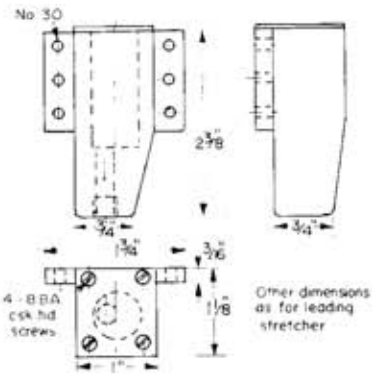
MAIN AXLEBOX OUTSIDE 2 OFF



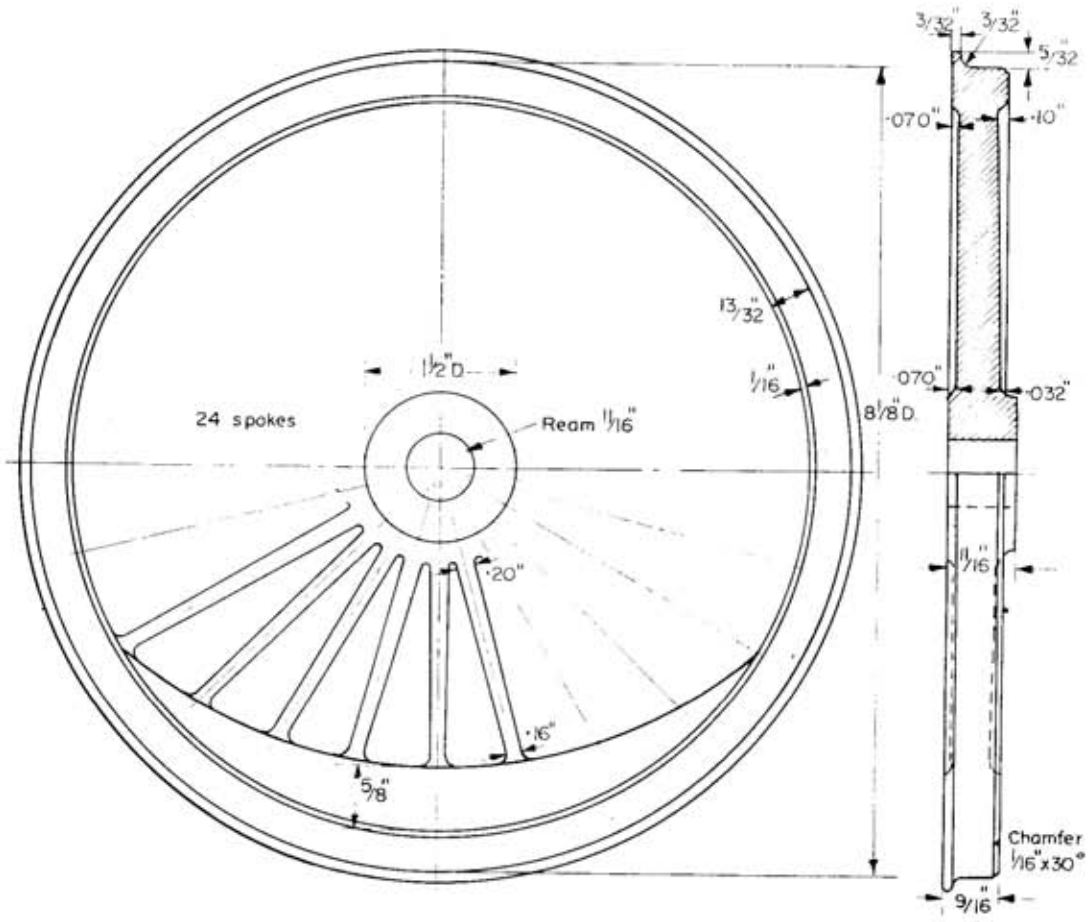
FRONT FRAME STRETCHER 2 OFF
BETWEEN INSIDE & OUTSIDE FRAMES
G M OR C I



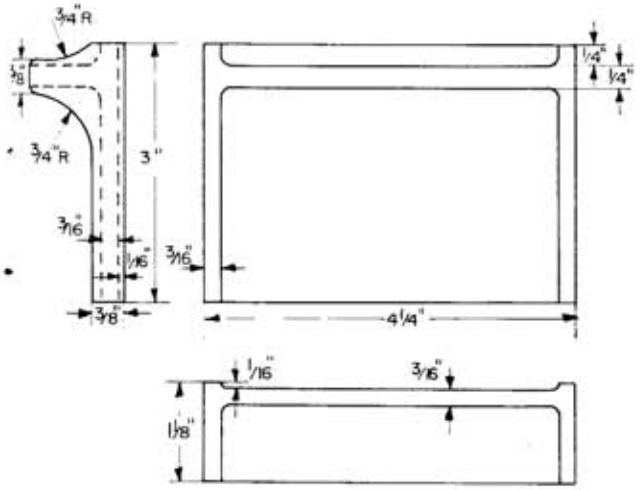
COMBINED STRETCHER & SANDBOX
(LEADING) BETWEEN OUTSIDE & INSIDE
FRAMES 2 OFF R H & L H L H DRAWN
G M CASTING



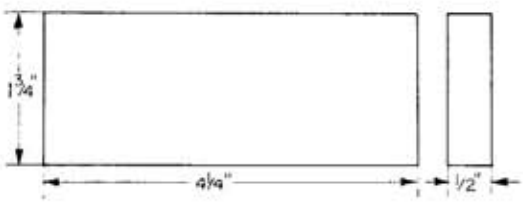
COMBINED STRETCHER & SANDBOX
(TRAILING) BETWEEN OUTSIDE & INSIDE
FRAMES 2 OFF R H & L H L H DRAWN
G M CASTING



DRIVING WHEEL 2 OFF C I.



MAIN FRAME STRETCHER (INSIDE FRAMES) C.I. OR G.M.



REAR FRAME STRETCHER (INSIDE FRAMES) B.M.S. OR C.I.

As regards the machining of the axleboxes, the main difficulty beginners have is to get the bores at an equal distance between the vertical working faces. (If the bores are a shade out in the vertical plane, it will not matter at all). But there are several methods for getting the bores correctly centred. One way is to rough machine all the sides, and top and bottom, using the four-jaw, then shift around in the four-jaw until the axlebox is as truly centred as you can get it. (If a D.T.I. is available, this can be done quite accurately.) Now take a finishing cut across one side, centre deeply, drill and bore, or bore and ream to finished size. Next make up a little jig, consisting of a steel plate about $\frac{3}{8}$ in. thick with true faces and edges, and fit in the middle of this a short length of silver steel of the diameter of the axle, of such a length a little less than the thickness of the finished axlebox. This is tapped say $\frac{5}{16}$ in. BSF and fitted with an Allen screw and brass washer. The width of this plate should be such that the axlebox slightly overhangs it at the sides. We now have a jig on which the axleboxes can be mounted in turn, under the toolholder, or on the vertical-slide, as preferred, for milling both the working faces and flanges, and if the builder has a graduated handwheel to his leadscrew, it becomes an easy job getting the flanges to equal depth.

Driving wheels

Although the driving wheels are of exceptional size, there is nothing unusual about them, nor difficulty in machining them, granted of course a big enough lathe ! Using lathes such as the Myford ML 7 or Super 7, they will be too large for chuck work. Start by giving the castings a good clean up with old files, working between the spokes if you want an " exhibition " engine. Now mount the wheel face outwards hard against the faceplate, using two clamps across the spokes, clear of the rims. Take a light cut across the tread and just enough against the side of the flange to true up. Also take a light cut across the rim and the balance weight. (The balance weight is flush with the rim on this wheel, as there is no crankpin or outside connecting rod to bother about.)

Now reverse the wheel and clamp against the faceplate, but this time insert three true packing strips between wheel and faceplate, not only to keep the wheel true, but to allow clearance for the protruding boss. Slacken the clamps slightly and shift the wheel around until the *tread* is running true. Centre deeply, drill, bore and ream $\frac{1}{2}$ in. dia.

The remainder of the turning operations are quite straightforward and as described many times in these notes.

Superheating

SIR,—In the July 17 issue Mr Holland writes as follows:

" The higher pressures will reduce condensation, but with superheating and in particular radiant superheat, this argument virtually falls away."

Of course, everyone can see that a high degree of superheat eliminates condensation, but the idea makes no more sense than would a similar claim that the adoption of air cooling in I.C. engines eliminates loss of heat to cooling water. In both cases, the basic loss must remain, the details being changed only.

Volume reduction and/or pressure drop due to cooling is greater with superheated steam as five minutes with standard steam tables will show. An attempt to get round this is often made by claiming that the dryness of superheated steam eliminates the loss of heat. For some reason, it is not mentioned that the temperature differences are some three or four times greater.

If Mr Holland or anyone else has the courage of his convictions in this matter, they can demonstrate the fact with a very simple test. A locomotive with a radiant superheater should be worked hard for several laps. If the exposed parts of a cylinder are then firmly grasped there will be a direct indication as to whether or not a high degree of superheating eliminates heat transfer effects. I have never done it myself, but then I believe in the general idea that boosting temperatures *increases* heat transfer effects. This certainly seems to apply elsewhere in engineering practice.

Whitefield, Manchester. J. CROSSLEY.

THE 1970 INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

Reported by D. E. Lawrence

WITNEY AND WEST OXFORD S.M.E. were hosts for the second International Model Locomotive Efficiency Competition. For the organisation of the event they had set up a special sub-committee comprising the chairman, Ray Smith, secretary, Ray Chilton, Pat Breasley and Tony Robinson, the last two members being responsible for various technical matters connected with the Competition.

Planning started some four months before and, just as Birmingham had found last year, there was a great deal to do. Response to the call for help was very good and all stewards, etc., came from within the Society. Members' wives looked after the catering and did an excellent job. I am always surprised by the way the ladies turn to at these gatherings, showing good-humoured tolerance of the menfolk and concealing any disappointment in finding the clubhouse kitchen does not differ from that at home, except in the number of hungry mouths there are. My grateful thanks to them, particularly Anna, for their prompt and kindly attentions.

The Society's track, which was opened in 1960, is set in the rich green parkland of Blenheim Palace. Tall old elm trees give plenty of shade and shelter and the lush grass makes a soft couch for the weary; altogether a pleasant setting indeed. The track is a ¼ mile circuit in the form of a blunt oval with a straight of about 260 ft. on the west side and one of about 300 ft. on the east side. At the south, the straights are joined by two equal length curves with a short straight in between. There are two unequal length curves at the north end, again connected by a short straight. Oddly enough, on a previous visit I was unable to find any member who could tell me the radius of the curves and I perforce had to measure them myself—by my rough measurement they were 100 ft. The east straight has a short swing bridge set in it and this can be traversed to allow vehicle access to the inside of the track. The west straight has a similar swing bridge which connects to round-house type steaming bays and a siding to the engine-shed workshop. The bays are made from a redundant portable track and are set at a reasonable working height above ground level.

The track is built on conventional lines; concrete piers at 8 ft. 6 in. centres support standard railway timber sleepers; upon this base is laid a concrete rendering about 1 in. thick which tapers on the curves to provide super-elevation. Upon the rendering, wide ⅝ in. thick sleepers are laid crosswise and nailed through into the timber base. Vignoles section aluminium alloy rail is used, fastened by clout nails to the sleepers. The track base is well aligned and was evidently carefully erected. Alignment of the rails is adequate and is about the same standard as at Birmingham. The height of the track varies from about 14 in. to 27 in. above ground level. Grades on the track are fairly modest but deceiving; there is a fall from the station of 1 : 125 followed by a level stretch; at the commencement of the short straight between the south curves the line rises steadily at about 1 : 200 to the station for a distance of some 500 ft. Tackling this stretch was to prove interesting! There is no anti-tipping device fitted.

The neat little station is set on the north-east curve and it has a Western air about it; here the track is at its minimum height above ground. Located within the track's perimeter is the Society's clubhouse; decorated in light colours, it is a clean and airy building some 35 ft. × 18 ft. in size. At one end is a modern

Opposite—the winner ! Len Labram's 5 in. gauge small Prairie "Firefly." On the right, ably driven by Len, the winner tackles the bank confidently.

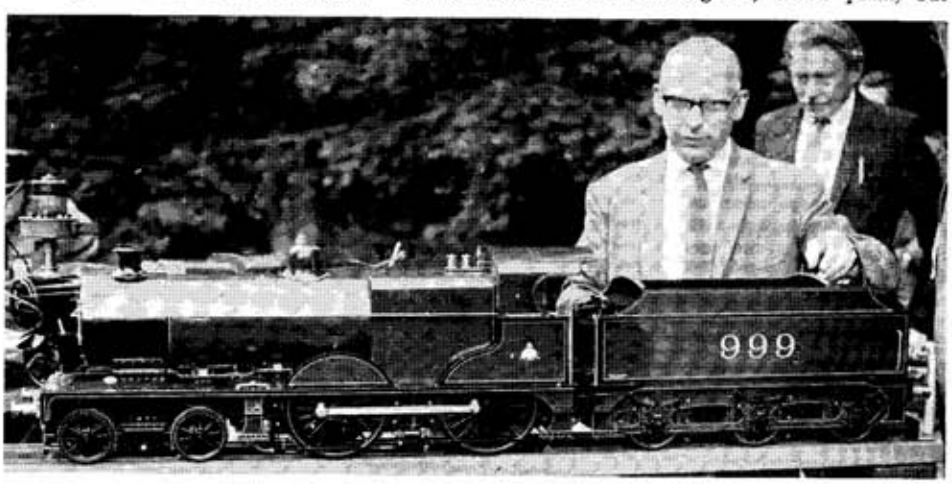
refreshment bar and the remaining space is ample for meetings, etc. Prior to the competition the Society announced an open day at Whitsun and they had hoped that intending competitors would come along to get the feel of the track. I understand there was not much response to this invitation by competitors, although there were plenty of other visitors. The Birmingham Society, showing an exemplary spirit of co-operation, loaned their dynamometer car to the hosts and, under the guidance of Messrs. Hughes and Tickle, Witney members became familiar with operation and procedures, they in fact had some dummy runs with the car before the event and so were able to cope without outside assistance on the day.

The Competition grows in popularity, this year's applications for entry exceeding the sponsor's limit of 16 which the fairly tight schedule necessitates. The hosts thought that any entry from them might have some advantage, however slight, and decided that they would not be represented in the competition.

The weather could have been kinder; lowering skies threatened rain but fortunately we had only a few very light showers during the day and the sun even managed a glimmer through the overcast sky a couple of times. Nevertheless, in spite of the weather, a large crowd attended. When I arrived at the track there was already a lot of activity in the steaming bays where Mr Green of Chichester, who was scheduled to make the first run, was raising steam on his *Rob Roy*. The host Society had decided that each locomotive would only be issued with charcoal for steaming up and would be given as much of this fuel to keep steam until ready to take the road. A prepacked weighed allowance of coal would then be given to the driver and he could, whilst moving on to the main line and being coupled to the dynamometer car, start to make up his fire. All coal actually used, but not that left in the bunker at the end of the run, was debited against the engine. On leaving the steaming bays there was roughly ¾ of a lap to the station in which time the driver could get a decent fire built ready for his run. At the station sufficient bogie cars were added to the train to accommodate whatever load the driver required. The load always included the "Observer," as at Birmingham last year, who recorded the dynamometer car readings during each run. Incidentally, W. & W.O. Society have articulated passenger bogies and a train somehow looked unfinished with a single pair of wheels trailing at the rear ! The bogies rode quite well and were comfortable. Only adult persons were permitted as passengers for the runs.

By 9.20 a.m. Mr L. A. Green had his *Rob Roy*, one of last year's entries, coupled to the dynamometer car and he set off for the station. This little 3½ in. gauge 0-6-0T locomotive runs very well, but as Mr Green ruefully admitted later, he had not quite appreciated how little heat value there was in the charcoal fire and had not properly built coal upon it, as a consequence he lost pressure and fire before reaching the station and retired from the run. The judges, entering into the spirit of the occasion, sportingly offered him another chance and Mr Green, undaunted, had another run later in the day.

Mr J. Edwards of the Whitchurch & D.M.E.S. was called upon to get steam up at short notice, and after a little delay, brought his locomotive on to the main line of run No. 2. Built by Mr Edwards' father, who it is sad to record died only three weeks before the competition, *Borwick Hall* is a 3½ in. gauge G.W.R. 69XX based on LBSC's *Lickham Hall*. The livery is unlined medium Brunswick green, rather plain, but



Silver medallist Peter Dupen and his impeccable 5 in. gauge Midland 4-4-0 came in second.

SECOND INTERNATIONAL MODEL LOCOMOTI

No.	Society	Driver	Gauge	Wheel arrangement	Description
1	Birmingham	L. Labram	5	2-6-2T	Firefly
2	Romford	P. Dupen	5	4-4-0	M.R. " 999 "
3	Willesden & W. London	J. Cousins	5	0-6-0T	Speedy
4	Chesterfield	N. Spink	5	4-4-0	Gooch
5	Bristol	D. S. Kellet	3½	4-6-0	Hall
6	Chingford	J. Dabson	3½	2-8-0	L.M.S. type
7	Urmston & Dist.	A. Eves (Driver Davies)	5	4-6-2	Princess Royal
8	Southampton	W. Perrett	5	0-6-0T	Speedy
9	Sutton Coldfield	R. Weaver	5	0-6-0T	Eva May
10	Brentwood	M. R. Harrison	3½	2-6-2T	Russell (N/G)
11	Brighouse & Halifax	G. Sherborne	5	0-4-2	Gladstone
12	Chichester	L. A. Green	3½	0-6-0T	Rob Roy
13	Whitchurch & Dist.	J. Edwards	3½	4-6-0	Hall
14	Kinver & Wolverhampton	T. J. Morris	3½	0-4-0	Tram engine
15	Stockport & District	F. Raw	3½	4-6-2T	Londonderry & Lough Swilly
16	Harrow & Wembley	R. Haines	5	0-6-0T	LBSC E1

the locomotive was clean and neat and showed good workmanship; it is about a year old. I liked the backhead arrangement of fittings which seemed well-positioned for easy driving. The boiler feed pump was unusual in that it was set up at a sharp angle abutting the saddle. The engine had a " flush-sided " tender modelled on the last series of G.W.R. standard 4,000 gallon tenders. The exhaust beat was crisp and clear and the locomotive was surefooted on the road, slipping very little with its load of five adults. I noticed a continuous small leak of steam from under the smokebox during the run. Mr Edwards took the first lap at modest speed, then with the lever fairly well down, ran smartly for several laps until the locomotive ran short of steam. Unfortunately he could not recover pressure and the run remained incomplete.

Run No. 3 saw Mr T. Morris of the Kinver and West Midlands S.M.E. on the track with his most unusual little locomotive. This was a 3½ in. gauge Burrell tram engine; it is a compound with an h.p. cylinder of ¾ in. dia. and L.P. cylinder 1⅜ in. dia., the working pressure is only 30 p.s.i.; the driving wheels are but 2⅜ in. dia. The coach body was finished in light blue livery and on the roof there was a nest of polished copper tubes, used as a condenser on the full-size version, its centre of gravity was therefore very high. Mr Morris told me the original worked in Birmingham in the 1880's. He elected to take as a load himself and the observer. The tram engine had a pronounced bobbing action on the track and it was most intriguing to watch it running. Speed was variable, sometimes rather slow, but at times it showed a quite surprising turn of speed. Most unfortunately the engine derailed on the south-east curve and was slightly damaged so the run was terminated.

Most regular readers of the M.E. will have heard of Mr Tucker of Bramhall, whose magnificent models of Beyer-Garratt locomotives have brought him well deserved fame. One of his other locomotives was entered for this competition and made the fourth run. This locomotive is his 3½ in. gauge (N.G.) model of a Londonderry and Lough Swilly Railway 4-6-2T originally built by Hawthorn Leslie for that railway. The locomotive has outside frames and fly-cranks and the cylinders are inclined at a sharp angle to the centre-line. A donkey pump, which is fitted alongside the smokebox, ticks over sweetly when pumping. As may be expected from Mr Tucker, this powerful looking locomotive is well made and well finished; it is about 10 years old. Mr F. Raw was the driver and he took a total of 13 adults as the load. At the start there was plenty of slipping and, early in the run, free escape from the safety valve, but Mr Raw soon had things under control and settled down to lap the track at a good speed. I noticed a steady leak of steam from the injector and at one time on the run, the locomotive was obviously priming. It was becoming apparent that the long up-grade was going to give drivers a bit of trouble. Attempts to get extra output from their locomotives usually resulted in excessive

OTIVE EFFICIENCY COMPETITION — RESULTS

	Distance (ft.)	Average D.B. Pull (lbs.)	Work Done (ft. lbs.)	Time (mins.)	Coal Used (lbs.)	Coal per D.B. H.P. hour	Place
	23,570	18.7	440,800	30.83	2.875	12.92	1
	24,900	16.0	398,400	30.35	2.687	13.36	2
	22,280	12.98	289,300	30.75	2.185	14.54	3
	15,700	15.33	240,600	29.46	1.812	14.91	4
	20,960	12.3	257,800	29.87	2.03	15.63	5
	20,940	9.21	192,900	29.58	1.656	17.00	6
	22,260	23.95	537,000	30.07	5.125	19.03	7
	19,640	16.05	315,200	30.5	3.344	21.00	8
	13,090	15.00	196,300	30.67	2.78	28.04	9
	17,030	10.5	178,700	31.62	3.25	35.99	10
	6,520	9.75	63,560	29.25	1.4	43.6	11
	—	—	—	—	—	—	Retired
	11,580	6.38	73,870	24.33	1.81	48.59	Retired
	5,020	3.57	17,930	20.75	0.59	65.61	Retired
	14,260	17.5	249,600	27.75	2.625	20.83	Retired
	—	—	—	—	—	—	Disq.

slipping at speed. Mr Raw tried opening up on the grade but had to ease a little to avoid undue slip. In the later stages of the run he lost pressure and was not able to recover it and the run was not completed.

The next run, No. 5, was the first to complete the 30 minutes allowed. This was by Mr E. S. Kellett of Bristol S.M.E. with a 3½ in. gauge locomotive based on the old G.W.R. "Hall" class. The locomotive is basically LBSC's *Ivy Hall* design which had a larger boiler than scale, running plates raised clear of the drivers and a very squat version of the famous Swindon "top hat" (safety valve bonnet). This 4-6-0, which was built by Mr Kellett's father, retained the larger boiler, but had running plates incorporating splashers at the correct level for a "Hall." Although the locomotive has been working for two years, it still has a few details to be added. Mr Kellett took a load of five persons and set off in fine style, maintaining a good speed—I timed one lap at almost 11 m.p.h. In the early stages of the run there was some loss from the safety valve and one stop was made to examine the train. For about 20 minutes were were treated to a fine performance from this locomotive in the hands of its competent driver, but unhappily, pressure began to drop and speed fell. Mr Kellett made recovery on the run and speed picked up, although the last stages were noticeably slower than the early part.

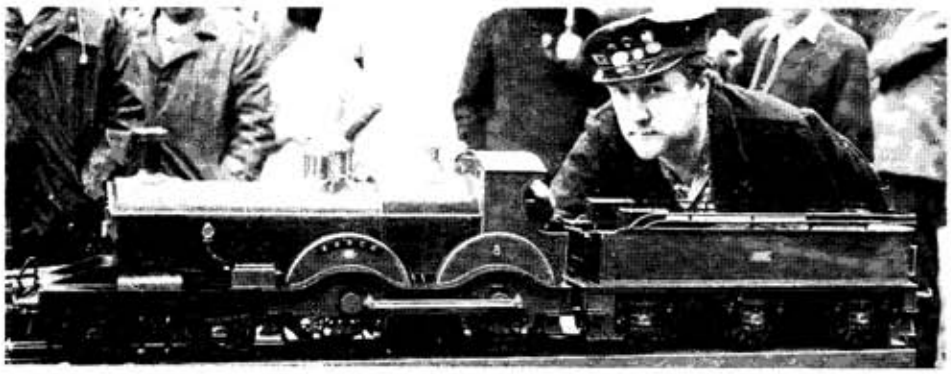
Mr M. R. Harrison of Brentwood M.E.S. and also of the S.M.E.E., made the sixth run. "Chips" Harrison suffered some good-natured leg-pulling; he has a collection of unconventional locomotives including a single "Fairlie," and two Welsh Ponies and it is alleged that he drives them with whip and spur! His current project is a rack railway locomotive, complete with (t)rack. The one he brought to Blenheim was not so unorthodox as the others and this was *Russell*, a 3½ in. (N.G.) version of a 1909 Hunslet 2-6-2T locomotive modelled in 1¾ in.-1 ft. scale and is one of the few locomotives I know which adhere to the outmoded dictum of "bore equals scale," though in *Russell's* case it is co-incidental. Finished in a livery of Indian red, sporting a very large polished brass dome and with outside frames and fly-cranks, *Russell* makes a handsome picture, marred only by the coal "Chips" insists on dropping all over the footplate. For the run the load was eight persons, which I know is fairly modest for this locomotive. After setting off at a good pace, speed varied considerably, usually becoming slower near the top of the bank. "Chips" tried to pile on more power on the long up grade, but extra regulator opening made the engine slip. *Russell* rocks a good deal when running and it is likely the coal consumption was adversely affected by some finding its way on to the track instead of into the firebox. In this connection, I wondered if any competitor had thought of fitting a chute in front of the fire-door to minimise waste. At the end of the 30 minutes allowed the run finished, with "Chips" and his locomotive, if not exactly covered with glory, liberally covered with oil splashes!

The well-detailed "Speedy," which placed third, being steamed up by its owner Mr J. Cousins.

Run No. 7 was allocated to Mr Green for his second attempt. Undismayed by his lack of success earlier, he left the steaming bays taking more care with the fire, but was again forced to retire due to valves not seating. This *Rob Roy* is a fine little locomotive and, at Birmingham last year, purred round the track quite ably, so perhaps we may see *Rob Roy* and its cheerful owner do better in some future I.M.L.E.C.

Mr J. Cousins of the Willesden and W. London S.M.E. was then called for run No. 8. His locomotive is a 5 in. gauge G.W.R. 0-6-0PT to LBSC's *Speedy* design. The valve gear of the engine is much modified; there is no superheater and the "wet" boiler has 39 tubes instead of—if memory serves me correctly—26 × $\frac{7}{8}$ in. dia. and 5 s/h flues of the original design. There was an interesting comparison coming up with Bill Perrett's *Speedy* which has the superheater boiler as original. Mr Cousins had a 5 in. gauge model of a 10 ton wagon which contained a water tank and this was coupled to the locomotive for the run. *Speedy* got away with a load of six persons without any trace of slip and I was interested to note the pronounced shouldering action of the locomotive in full gear at low speed. Mr Cousins had evidently thought carefully about the conditions, the light load was deliberate on his part and, although he ran with the lever well notched up, the regulator was only open by a small amount. Speed was not high and was pretty steady throughout, but it fell off a little on the bank. There was negligible loss from the safety valve and the locomotive was steam tight. For a "wet" steamer the exhaust was fairly dry. Altogether this was a quiet and steady run, competently made.

The Brighouse and Halifax S.M.E. was again represented this year and run No. 9 was made by Mr E. L. Dargue's locomotive, which is an 0-4-2 L.B.S.C.R. *Gladstone* built by Mr Scarth, who last year entered its sister locomotive *Ed Blount* in the first I.M.L.E.C. There is little embellishment externally and *Gladstone* looks rather plain and is almost austere, but it has what I call a driver's cab and it is well made and businesslike. For the run the driver was Mr G. Sherbourne and he elected to take a load of five persons. He started very well, little slipping only and, with these large coupled wheels literally striding round the track, I thought we would see another steady run. But that long up grade again took its toll and speed was frequently reduced. Now and again *Gladstone* was in trouble for steam, at one time just crawling into the station. Mr Sherbourne managed to make



Norman Spink and the picturesque "Gooch."

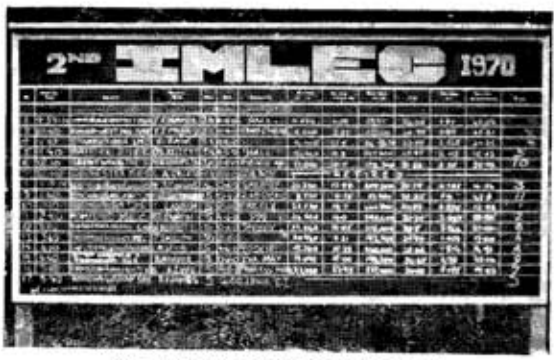
Mr J. Edwards raising steam on his 3½ in. gauge G.W.R. 4-6-0 "Borwick Hall."

recovery on the run but later had to stop once. However, the run lasted the full 30 minutes.

Firefly is a design by Martin Evans and who could blame him if he bore a pleased and slightly proprietorial air when seen examining Mr Labram's entry. This locomotive, a 5 in. gauge version of the old G.W.R. 45XX 2-6-2T—known as the small Prairies—is about 18 months old. Mr Labram said he had built it almost to drawings, but had fitted a disc-in-a-tube regulator instead of the screw down type and had modified the lubricators. The Great Western did not bother to line out freight and secondary locomotives, but this small replica, in mid-Brunswick green, full lining and side tanks adorned with full lettering, looked very handsome indeed. It was well detailed and well finished, the riveting being particularly neat; access to the cab is not very good, but this is a feature inherent in a model of this type. It was announced that this, the 10th run, was a "works" or supporters special, all 11 persons on the train coming from the Birmingham society. Mr Labram handled his locomotive in a most able fashion, driving well and keeping up a fairly constant good speed at around 9 m.p.h. He took the long bank confidently at a run and was only slowed a little by it. There was one station stop, which appeared to be for water. The host Society had set up a large notice board, see photograph, on which was entered the result of each performance as it was known. One felt that Mr Labram's effort was going to come out near the top and, when this performance was put on the board, it was obvious at that stage, he held prior place, a position he was to keep for the rest of the long day.

Peter Dupen of the Romford M.E.S. and also the S.M.E.E., has a reputation which is not entirely undeserved of being something of a "speed merchant." Prior to the 11th run he also endured some leg-pulling about keeping below 90, and an offer to sit on the boiler for extra adhesive weight was smilingly declined! Peter's entry was his Midland "999" 5 in. gauge 4-4-0, which, at a recent M.E. exhibition, and competing against Bill Carter's superb Atlantic, was awarded a silver medal, a tribute to its excellence. The work and detail on the locomotive is very fine indeed and it performs as well as it looks. It is fitted with a radiant superheater, a quite recent modification, and was an obvious challenge to Mr Labram's 45XX. Taking a load of nine adults, Peter started off in fine style, the engine fully master of its job, but again that long bank proved a real trial and although the locomotive was capable of better performance, speed was reduced on the bank due to slipping. Peter is a very

A. W. G. Tucker's L. & L.S.Rly. Hawthorn 4-6-2T driven by Mr F. Raw at the beginning of one of the gradients.



The scoreboard set up by the host club.

Bill Perrett, Southampton, prior to the " off " with " Speedy " coupled to the useful model wagon.

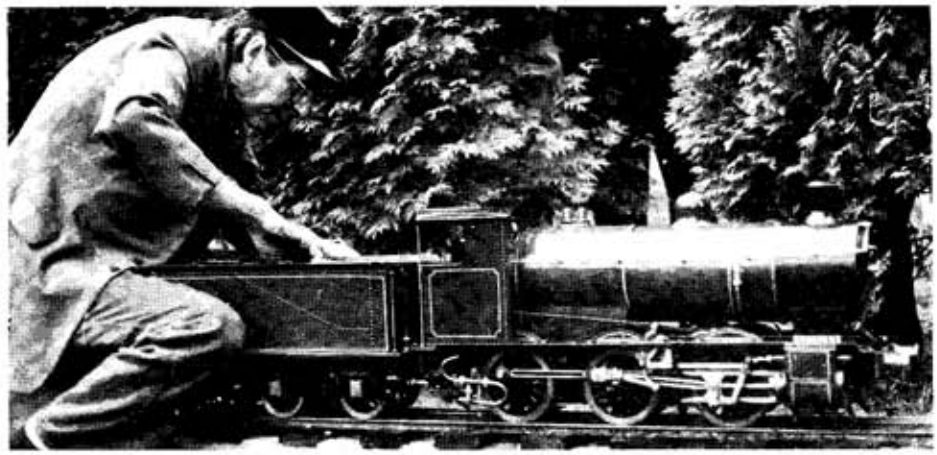
proficient driver, but even with the most careful handling of the regulator he could not just get that bit extra when needed. A light fall of rain had made the rails a little greasy and this told against the engine. The locomotive had a nice crisp beat when running and, in Peter's capable hands, there was little loss from the safety valve. He had two laps which were markedly below standard, but made recovery on the run frequently lapping at some 9 m.p.h.; all told this was an excellent performance. Peter finished, as is usual with him, splattered with oil, but still smiling. The results of his run showed him very close to Mr Labram, but not quite there; in fact he took second place.

Run No. 12 was allotted to Mr W. Perrett of Southampton M.E.S. Bill's locomotive, very well known for its prowess on his home track, is an 11 year old 5 in. gauge G.W.R. 15XX *Speedy* to LBSC design. It is fitted with a standard flue tube superheater, the valve gear is modified to give better events than the original design and he has put a short " brick arch " made of Ankerloid material (that might be Anchorloid) in the firebox. Cylinder oil is supplied via a sight-feed lubricator of the type developed by Fred Cottam over 20 years ago; the locomotive was the only one in the competition so fitted. Like Mr Cousins, this *Speedy* had a model wagon, borrowed from Keith Gammage of Southampton, coupled up behind for extra water supplies. The Southampton boys are alleged to be a " hell-for-leather " crowd, which arises from their great enthusiasm and Bill also suffered some leg-pulling. He took a load of 14 adults and for some 20 minutes we witnessed a very good run at a smart but not excessive speed, with capable driving and the long bank taken surely and confidently. In the late stages of the run, pressure fell and speed was considerably reduced, the train coming to a stand at the head of the bank on the north-east curve. This was a great pity as Bill had been doing very well up to then; he went on to complete his 30 minutes allowance.

Bill said later that the coal did not behave as expected and, when he put the rake through the fire, the coal disintegrated into a mass of small flakes and splinters. The smokebox was about half-full of partly burned char and it was fairly evident that this was the reason for the deterioration of the run and Bill's hopes of coming near the leader were swept on to the ground with the char. The coal used was " Stove Esse " small nuts, a type of anthracite, and drivers' opinions as to its quality varied from non-committal " it's alright " to " it was not what I expected." The remains of the fuel dumped on the steaming bays showed a few odd pieces of slate, very little clinker, some whole cinders, a good deal of flaky half-burned cinders and some ash. Because of these circumstances I gave up the idea of drawing any comparison between the two *Speedys*.

The purposeful L. & B.S.C.R. E.1 belonging to Mr Haines.

Anxious moment for Mr Weaver while "Eva May" restores pressure very quickly.



Bill said that in trial runs on the Southampton track he had returned figures of less consumption for similar work done. Possibly a competing locomotive could have a suitably proportioned blast pipe for whatever fuel is used, but this seems a very drastic step to take for the conditions and spirit of the competition.

Mr Dabson of Chingford M.E.C. was another whose locomotive had competed in last year's I.M.L.E.C. The locomotive is a 3½ in. gauge 2-8-0 L.M.S. 8F, a handsome purposeful engine, now 14 years old, well maintained and in good condition, with no sign of steam leaks anywhere. For run No. 13 Mr J. Dabson took a load of five persons and from a good start, set off on what augured well for an excellent run and possibly an improvement on last year. At times speed was well up and the locomotive comfortably master of its job. Unfortunately a little fine rain fell and on the wet alloy rail, the wheels lost their grip. The co-efficient of adhesion disappeared so far below unity that the locomotive was brought to a standstill. Mr Dabson was most unlucky with these track conditions. He had been giving us a display of competent driving with a locomotive in good nick; however, he persevered and finished his allotted half-hour.

Norman Spink's *Gooch* had also run in the first I.M.L.E.C. *Gooch* is a 5 in. gauge G.W.R. "Armstrong 4-4-0; it was in fine condition, the bright work shone and it again attracted an admiring crowd in the steaming bays. Norman's was the 14th run and he took a smaller load this year, a total of nine people. *Gooch* got away to a clean start with no slip and the exhaust sounded crisp and even. After the first lap Norman made a quick stop to re-fix an engine/tender pipe. Restarting from the stop was made a trifle hastily leading to excessive slipping as the start was on the bank. All competitors so far had had varying degree of trouble in negotiating the long bank and *Gooch* was no exception, occasionally being well slowed by it. Perhaps this bank is not 1 : 200 after all! A light dusting of rain in the early stages did not help and it must have required all Norman's skill to keep this four coupled locomotive "at the collar." For the latter half of the run, the rails dried off a bit and performance then improved.

Run No. 15 was made by Mr R. Weaver of the Sutton Coldfield M.E.S. with his 5 in. gauge *Eva May*. This is a superheated 0-6-0 tender locomotive and the design was by LBSC, the only 5 in. gauge design published by him pre-war. It had been built by a Wolverhampton engineer sometime in the 1930's and had been

Below: The diminutive tram engine hauls owner Mr Morris and observer.

Below: "Rob Roy" with good head of steam prepares to commence the run.

rebuilt by Mr Weaver. The locomotive looked clean and smart in its red livery and had obviously been carefully restored. The roomy cab and tender of medium height made the controls easily accessible. The run was another " works " special, all eight persons on the train were from Sutton Coldfield. On the run the exhaust was fairly wet and this was probably because of a high water level in the boiler. The train came to a stand on the south-east curve at the foot of the bank, due to lost pressure. I only had time to quickly record this embarrassing moment on film before Mr Weaver had 80 lb. back on the " clock " and had restarted, albeit a little uncertainly. Thereafter *Eva May* put up a steady performance for about 20 minutes until towards the end of the run when pressure fell, but Mr Weaver carefully nursed his engine and managed to complete the run without further stop.

The largest locomotive entered was from the Urmston M.E.S. and this was Mr A. Eves' 5 in. gauge 4-6-2 *Crewe Hall*, modelled on the first series of Stainier L.M.S. 7P Pacifics. Mr Eves' model has the four-cylinders according to prototype and it was neatly finished in L.M.S. red livery. The load for this, the 16th run was 12 people and the locomotive was driven by Mr Davis. I remember driving *Crewe Hall* at an M.E. exhibition about two years ago and I did not envy Mr Davis having to stretch over that big tender and, at the same time, try not to affect the recorded drawbar pull by leaning on it. The run can best be described as uneventful, the engine taking its modest load quite comfortably and only requiring a little extra regulator on the bank to prevent speed falling appreciably. I noticed on two occasions the driver had to make a swift dab at the regulator to prevent speed rising too much on the down grade. Evidently, with a load like that, the engine will " gallop " when given its head. In the gathering gloom it was not easy to see the exact position of the reverser and I could not be sure how far back the lever was; I thought the beats sounded a little uneven.

The last run No. 17, began late in the evening and there were still plenty of people about to enjoy it. Mr Haines of the Harrow & Wembley S.M.E. now took the track with his 5 in. gauge 0-6-0T L. & B.S.C.R., E.1, which bears on its side tanks the name *Barcelona*. The locomotive was awarded a silver medal at a recent M.E. exhibition. Of all the engines there, this was the one I itched to drive and the one which impressed me most. Its old-fashioned but smart appearance belies the eminently practical and purposeful nature of the machine. Mr. Haines had ingeniously concealed a lot of extra metal in the locomotive so that its adhesive weight was 150 lb., which by my rough on-the-spot reckoning gave an adhesive factor of about 2 : 1 or possibly a little more. The engine was fairly new and had been developed from LBSC's *Pansy* with boiler and superstructure to suit the E.1 outline. This run was another supporters special and the load was seven people. With plenty of adhesive weight *Barcelona* made a clean and sure-footed start and proceeded to lap the track steadily. The bank was taken quite confidently with little loss of speed, the driver being able to open up as necessary without the locomotive " losing its feet." This was an excellent run by a most able engine in good hands and I was very disappointed to hear the official announcement that Mr Haines' run had been declared void. It seems that the dynamometer car recordings were inconsistent and appeared to have been inadvertently upset, leaving the officials little option with their decision. It was then quite late in the evening and there was no prospect of a re-run. Mr Haines can be consoled that he can have another go later, and indeed, I hope he will do so.

The day was brought to a close by a short informal ceremony outside the clubhouse. The secretary, Ray Chilton, addressing a still sizeable crowd, said that he had some apologies to make; had the event finished earlier, the Marchioness of Blandford would have made the presentations, but other commitments compelled her attendance elsewhere. He went on to say that they were conscious that this was also a big social occasion and were very pleased to have staged the I.M.L.E.C. on their track, and they had enjoyed playing hosts. Martin Evans was then introduced and we were told that Mrs. Barbara Cleaver, Vice-President A. C. W. Cleaver's wife, would present the prizes, but first the winner of last year's I.M.L.E.C. would receive his Replica Cup, thereafter presentations would be made in reverse order—à la Miss World !

A smiling Mrs. Cleaver then presented John Drury of Birmingham with his Replica Cup followed by :
Fourth prize to Norman Spink, *Gooch*.

Mrs. Barbara Cleaver presenting the trophy to Mr Labram (back to camera) watched by smiling Martin Evans (right).

Mr Davis driving Mr Eves' 4-6-2 L.M.S. "Princess Royal," waiting to be uncoupled from the train.

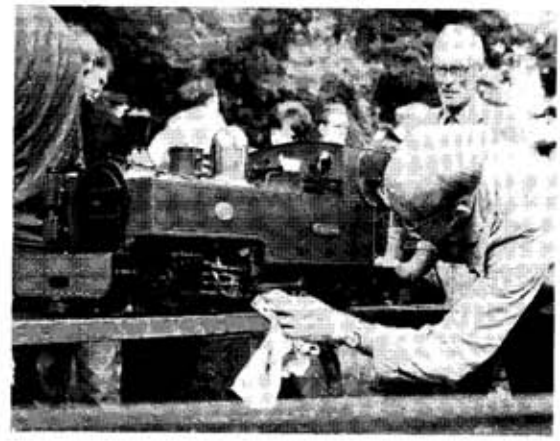
Third prize to Mr J. Cousins, *Speedy*.
Second prize to Peter Dupen, Midland 999.
Cup and First prize to Mr L. Labram, *Firefly*.
Martin Evans concluded the ceremony by giving a well merited commendation to the competitors who had taken Fifth and Sixth places. In the informal gathering in the clubhouse later, he asked Mr Chilton, on the Society's behalf, to accept his personal thanks for their splendid efforts in staging the competition.

On a personal note: At Birmingham last year I found friendship and co-operation and was given every help in my reporting task. A similar spirit was manifest at Woodstock where everyone was helpful and friendly, in spite of their demanding duties. My personal thanks to them for making my "volunteer" labour that much easier. My thanks also to the competitors, who bore my questions and photographic efforts with patience and good humour.

The impressions I took away with me were of the well-behaved visitors—it was again an all-ticket function and most of them were live steam fans—an excellent organisation which kept things moving with the minimum of fuss: the good spirit shown by the competitors in spite of a few disappointments.

Witney and West Oxford did not attempt Birmingham's more ambitious analysis of the data obtained but contented themselves with the simpler process of finding the winner from the coal per d.b.h.p. hour figures. There are some interesting features: from about the fifth run, competitors rapidly recognised that they had three-quarters of a lap only in which to build up a proper fire and most began to use their coal allowance before leaving the steaming bays. The "works" or supporters specials are a new feature and the I.M.L.E.C. shows signs of becoming an occasion for organised club outings. The winning locomotive had a normal flue tube superheater, whereas last year's winner had a radiant type and it is interesting to speculate (but probably unprofitable) on what either would have done with a superheater of different proportions or different type. John Drury's locomotive returned an efficiency figure of approximately 5 per cent, Mr Labram's locomotive returned approximately 1½ per cent (I don't know the c.v. of the Stove Esse fuel), Peter Dupen's locomotive was approximately 1¾ per cent, Messrs. Cousins and Spink were both around 1¼ per cent. From the published data, a direct comparison can be made in respect of the two years' performances by two locomotives:
Mr Spink's *Gooch*,
approximately 27 per cent more time run in 1970 than in 1969, approximately 9 per cent more work done than in 1969, approximately 200 per cent more fuel used than in 1969 (1969—0.6 lb., 1970—1.812 lb.), 1969 efficiency approximately 3.3 per cent, 1970 approximately 1.25 per cent.
Mr Dabson's 2-8-0,
approximately 28 per cent more time run in 1970 than 1969, approximately 43 per cent more work done than in 1969, approximately 115 per cent more fuel used than in 1969 (1969—0.77 lb., 1970—1.656 lb.), 1969 efficiency approximately 1.38 per cent, 1970 approximately 1.1 per cent.

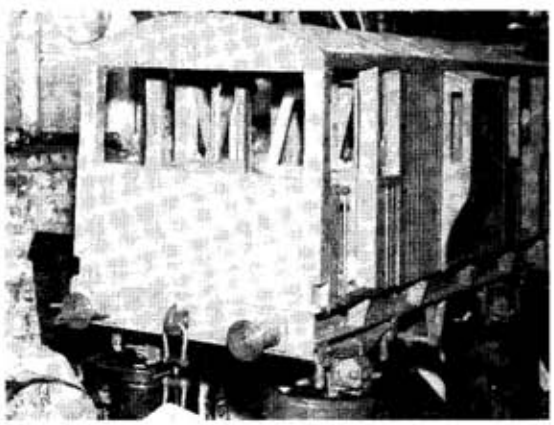
On this basis, Mr Dabson's performances are fairly consistent. The overall efficiencies of the first half-dozen engines this year are grouped together more closely than last year. I suppose it is too early yet for a pattern to be established, we shall probably have to wait a few years for a trend to be shown. The reasons for the closer grouping probably lie in the fact that the track time was extended to 30 minutes and that, although at times conditions were adverse, the quality of driving was generally good. I thought that the general quality of this year's locomotives was also very good. From the results, it seems the system of fuel rationing used was fairly effective. Jim Ewins was responsible for developing and printing most of the photographs shown here, from my negatives, and a good job he has made of them. ▣



Mr M. Harrison gives his 3½ in. gauge Hunslett 2-6-2T "Russell" a spot of beauty treatment.

JEYNES' CORNER

THE NORTH EASTERN RAILWAY

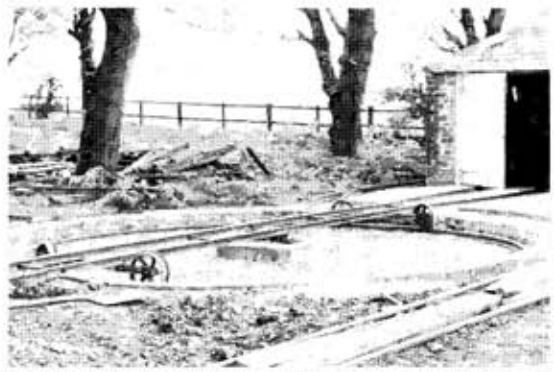


Top photograph : One of the locomotives, designed by Henry Greenly in 1909. The first 15 in. gauge petrol engine driven locomotive to steam outline.

Centre : A vehicle under construction in the wagon shop.

Below : The locomotive running shed which has two roads, and one of the signals.

I HAVE AT DIFFERENT TIMES mentioned the 15 in. gauge locomotives designed by Henry Greenly, and built in the first decade of this century: the first scale steam locomotive *Little Giant*, and the first petrol driven locomotive built to steam outline. Both these locomotives have been acquired by Mr Thomas Tate to provide motive power for a miniature railway he proposed to lay down in his grounds. A third locomotive has also been acquired, and is now in course of rebuilding in the locomotive shed, in which I noticed more machine tools have been installed since my last visit; all of these have individual electric drives.



The turntable or transhipper which serves five roads, in its skeleton form.

The unfavourable weather experienced in the past months has greatly retarded the laying down of the permanent way, but now outdoor work is in full swing. This does not mean however that nothing was done during the inclement weather; when outdoor working was

Below : The partly completed signal cabin and island platform.

impossible, the time was not wasted, as a visit to the wagon shop showed a vehicle in a well advanced condition; this will of course be fitted with vacuum brake.

A signal gantry is in course of erection at the approach to the Central Station, where the platforms are taking shape. A signal cabin is being erected on the island platform, which contains a full-size hand lever frame, which will eventually operate the signals (post), and ground signals and associated points; a number of

Continued on page 876

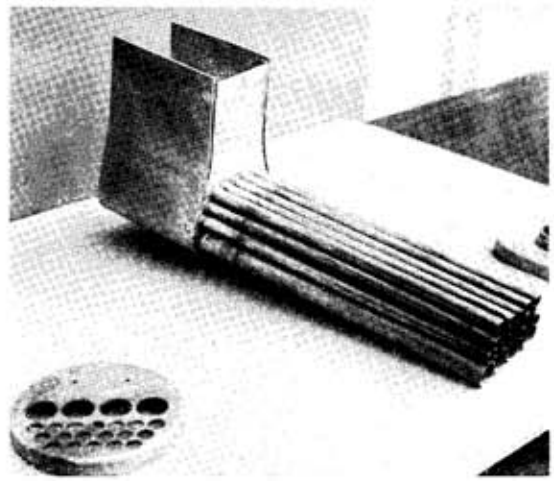
BOILER MAKING TODAY

Norman Spink and David Mellors of Chesterfield Model Engineers have been trying the latest methods

THE FIRST BOILER I made was for a 5 in. gauge *Springbok*. This was in 1965 and being new to boiler making I worked strictly according to the methods laid down by Martin Evans in his articles in M.E. I read all I could find in past issues and all the experts seemed to agree with LBSC on the best way to tackle this formidable task. So the boiler was built to the "words and music."

Using propane, and the top of the wall as a hearth, all went well until I came to the staying process. Here, the business of drilling over 200 holes in 10 gauge and 13 gauge copper cost a few broken drills. Similarly, the tapping of all these holes cost more than one 5 BA Tap. The stays were nutted on the inside and riveted on the outside, then silver soldered on the outside and sweated over with soft solder on the inside. This proved to be quite a long job and called for numerous fillings with water, pumping to pressure, and then re-heating for correction. Eventually, the boiler held 250 p.s.i. but I was never very happy about the method of building and the resulting soft solder if the boiler was ever allowed to go low on water.

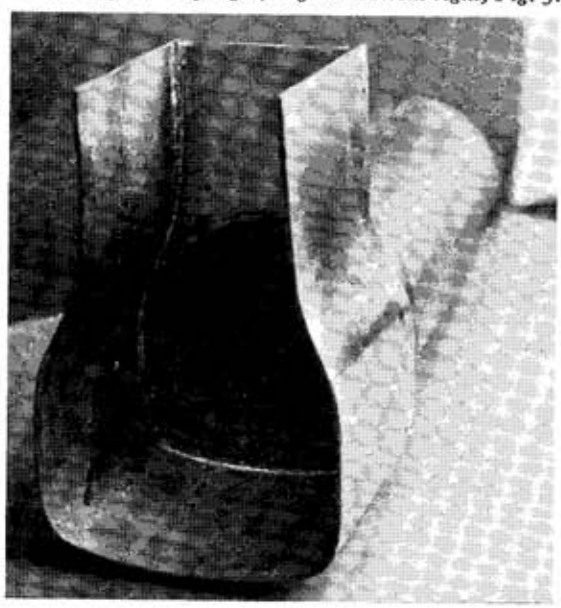
I went on to build boilers for 3½ in. gauge *Juliet* and 5 in. gauge *Speedy* according to the "words and music" but always on the lookout for improvements. Last Spring (1969) David and I were planning two *Simplex* boilers and decided to try to do something about the soft solder and tapped stay business.

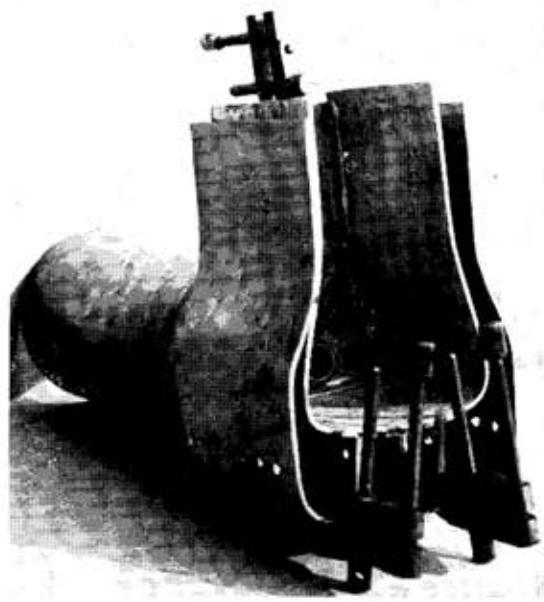


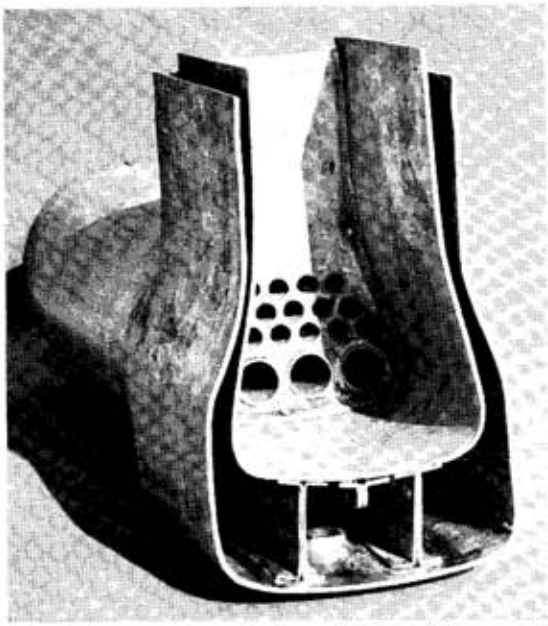
Some months before, I had spent half a day with Alec Farmer of the Birmingham Society who had been kind enough to explain in detail how he built boilers without soft soldered stays and although he used oxy-acetylene, I thought it could be done with propane.

The two *Simplex* boilers were a complete success. We followed with a 3½ in. gauge *Doris* Belpaire type boiler which again proved successful; so when we were planning a 5 in. gauge *Pansy* boiler which is a Belpaire of average size we thought

Below, Fig. 1. Top right, Fig. 2. Bottom right, Fig. 3.





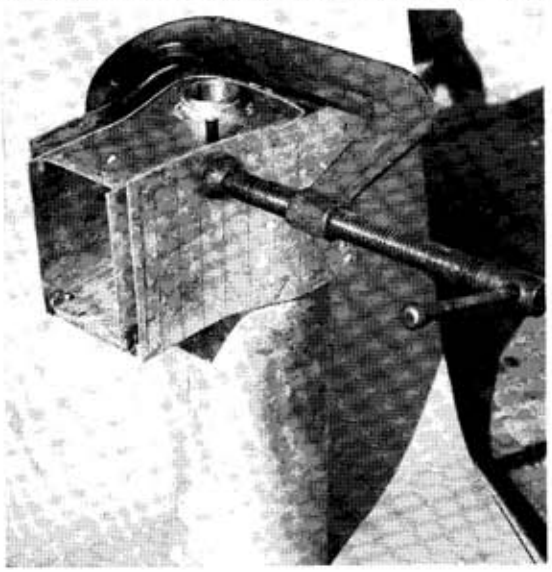


an article on the method would be of interest to readers. So, by kind permission of Alec Farmer, this is it.

The essentials we were looking for were :

1. The boiler should be as strong as possible, hydraulically tested to twice working pressure.
2. Silver solder throughout.
3. Easier to build than traditional.
4. Only propane or town gas to be used.

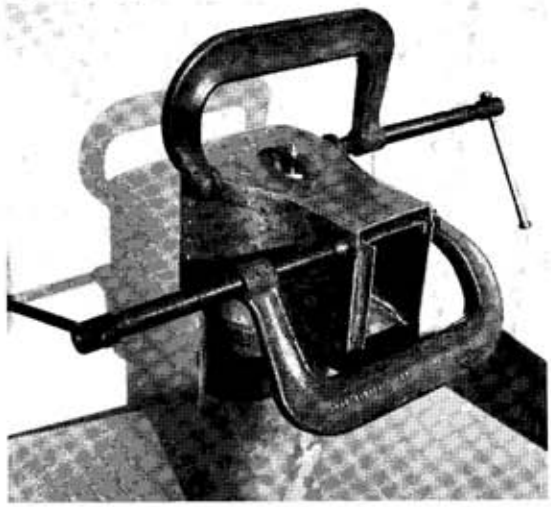
All these conditions were fulfilled with an added bonus of lower cost. It is worth adding that at no time did we find it necessary to use coke for heat retention but more often than not used two propane burners.



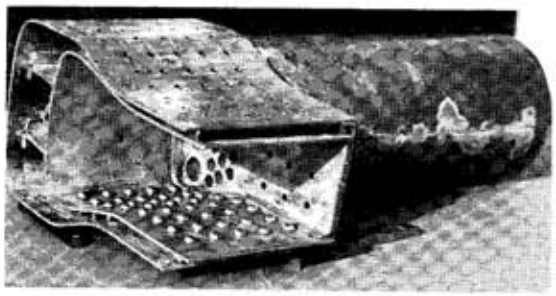
Firstly, the various unit parts are prepared. Plates are flanged, and we think ½ in. former plates are worth the extra work involved, particularly if you can get a club member interested in making the same boiler and willing to share the work of producing such plates. The barrel is rolled and joined with a covering strip, riveted at about 2 in. centres, and brazed with C4. We decided to use C4 as far as possible as the boiler progressed on three counts. (1) stronger joints, (2) will not soften when working on later parts of boiler to be done with Easyflo, (3) costs less than Easyflo.

The barrel is brazed to the throatplate which in turn has the outer firebox wrapper riveted to it and brazed with C4, a minimum of rivets being used—just enough to keep it in place whilst brazing. After all, the rivets form no mechanical strength and are a source of potential leaks. On *Pansy*, we used seven round the wrapper.

Top left, Fig. 4. Bottom left, Fig. 5. Below, Fig. 6.



The firebox tubeplate is prepared in the usual way but here we "had a think" and decided to deviate a little. Johnson Mathey, the manufacturers of the silver solder, recommend a gap of from .002 in. to .006 in. for best penetration and formation of fillet. With this in mind, we could not see the point of the traditional reamed hole fit for the tubes into the tubeplate, so we decided to drill the tubeplate less than tube size. For *Pansy*, which has ⅞ in. tubes, a 27/64 in. drill was used and then to stop the tubes falling through when brazing a small shoulder is formed on one end of each tube. This gives positive location of the tubes when brazing but allows a fillet of silver solder through the joint. It will be seen from the picture that the tubes are varied slightly in length, this is intentional and



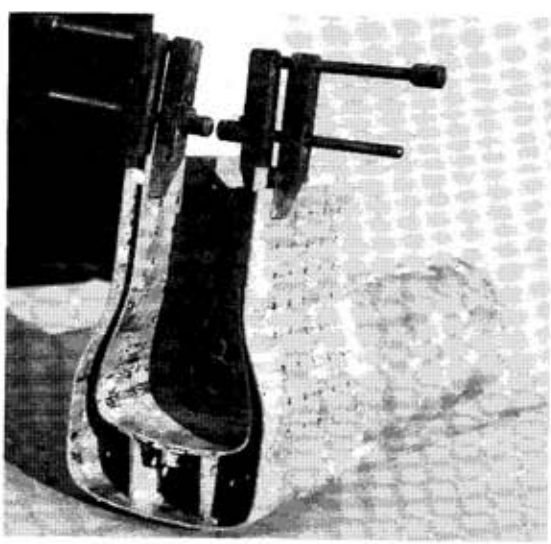
makes much easier the fitting of the smokebox tubeplate.

So, the firebox tubeplate is riveted and brazed to the firebox wrapper with C4 and then the tubes are put in. To make sure that the joint of every tube can be examined inside and out we only fix one row of tubes at a time, pickling between brazings, a little time consuming but worth the effort —C4 again, of course.

At this stage, the smokebox tubeplate can be prepared, the holes being opened out to an easy fit on the tubes. The crown girder stay can be fitted with C4. Rivets can be used to hold the stay in position but on *Pansy* we brazed it into position without any rivets—just gravity ! Rivets are potential leaks.

The firebox and tube assembly is now put into the shell for a trial. The front part of the foundation ring is clamped in place and a check made that the bottom row of tubes are clear of the throatplate. The crown stays can now be made to the actual distance between the firebox and the outer wrapper, "I" section stays being assembled with C4.

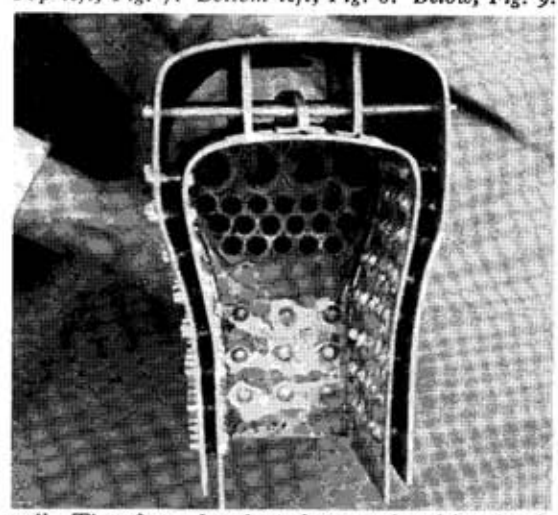
The next step is to braze the crown stays to the firebox top using C4. A single rivet is used in each stay to locate whilst brazing. At this stage it is worthwhile fitting, again with C4, large bushes to the outer shell, i.e. dome, safety valve, etc.



The inner assembly is now refitted into the shell, taking care that the crown stays bed down to the outer wrapper. Refit the front foundation ring (shades of Pat ?) and secure with a few clamps. Two $\frac{1}{16}$ in. holes are drilled through the throatplate, ring and firebox tubeplate for the eventual riveting.

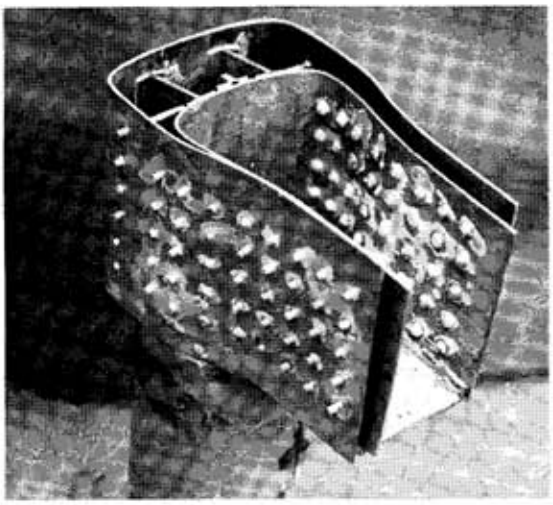
You will notice that no mention of holes in crown or girder stays for cross stays has been made. This is intentional as the alignment of the cross stays is not always certain. The strength of the traditional cross stays, and longitudinal stays, held by blind nipples seems dubious as they rely on threaded copper rod—a difficult thing to make well. Therefore, they have been replaced by simple lengths of copper rod silver soldered into place.

Top left, Fig. 7. Bottom left, Fig. 8. Below, Fig. 9.



Mark the cross stay hole centres on both sides of the outer wrapper and drill clearance holes for the stays ($\frac{7}{16}$ in. on *Pansy*) through the outer wrapper and crown stay—from each side. Remove inner assembly and enlarge crown stay holes (to $\frac{3}{8}$ in. on *Pansy*). Using these holes as pilots drill the girder stay.

Re-assemble, put $\frac{1}{16}$ in. rivets through predrilled holes in throatplate ring and firebox tubeplate. With clamps holding crown stays tight to the wrapper, braze the front of the foundation ring into place with C4. Remove clamps and braze crown stays to wrapper with Easyflo. The firehole ring is turned to size, using either thick walled tube or a fabrication from 10 gauge sheet, and then brazed into position on the firebox doorplate with C4. With the firebox doorplate in its proper position, squeeze the firebox wrapper into close contact using packing pieces and a cramp. Re-

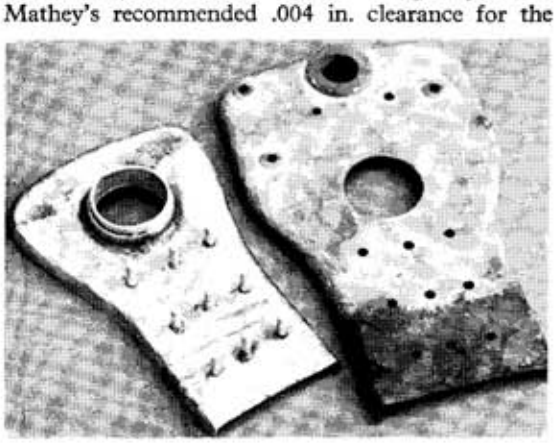


move cramp and packing pieces, when you are satisfied; fit the backhead and mark the position of the firehole in it. Remove the backhead again and cut out the firehole.

It is virtually impossible to heat the inside of a completed firebox to the melting point of silver solder using propane or town gas because of lack of air for combustion. If, however, the firebox doorplate is left off this heating presents no difficulty. We therefore fit stays at this stage.

Pieces of copper rod silver soldered into place would make perfectly adequate stays but difficulty could be found in holding them in place whilst silver soldering. A rivet however, because of its shape, will not fall through the holes and hence makes a perfect stay.

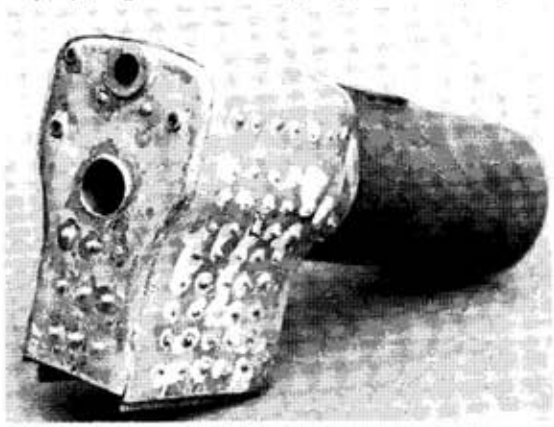
Clamp the firebox doorplate and backhead together, using two bars and a bolt and fit into position. Cut and fit the foundation ring sides and clamp into position. The stay centres are now marked out and drilled, in the sides and front of the firebox, with a drill which will give Johnson Mathey's recommended .004 in. clearance for the size of rivet to be used. Then, remove the backhead, doorplate and foundation ring sides. After removing burrs, lightly countersink stay holes in the outer wrapper to allow a good fillet of silver solder to form round each stay.



Lay the boiler on its side and insert some rivets as shown in the photo. Apply plenty of flux, around the heads, and silver solder with Easyflo, taking care not to overheat the tubeplate. However, as the tubes were put in with C4 there is little danger of the solder running off the tube ends. Turn the boiler on the other side and repeat the process. If the boiler is now stood on the smokebox end, the inside ends of the throatplate stays can be soldered.

Fit the cross-stay rods and with the boiler on its side, solder the stay ends with Easyflo. The other side and the throatplate stays can then be soldered at the same heating. With the backhead and firebox doorplate located by the firehole ring and still clamped together, mark out and drill for stays.

Top left, Fig. 10. Bottom left, Fig. 11. Below, Fig. 12.



Dismantle and fit rivets to firebox doorplates, heads inside, and solder with C4.

The firebox doorplate can now be fitted into the firebox and soldered with Easyflo. Clamping the bottom corners or gripping as in the photographs should be sufficient to hold it in place.

After soldering the bushes into the backhead with C4 place into position over the stays and firehole ring. Longitudinal stays are now fitted, again plain rod is ideal, lightly riveted to hold in place whilst soldering. Remember a silver solder fillet inside and outside is many times stronger than threaded nipples and of course less likely to leak. All this assembly can now be soldered with Easyflo —go round the outside of the backhead first and then do stays and firehole ring. The three remaining parts of the foundation ring are now fitted. One or two 7/8 in. rivets will be enough to hold in place. Any small gaps can be filled with odd bits

Continued on page 878

Lathe Tools *Part II*

by Ian Bradley

Continued from page 820

Tool shapes for internal work

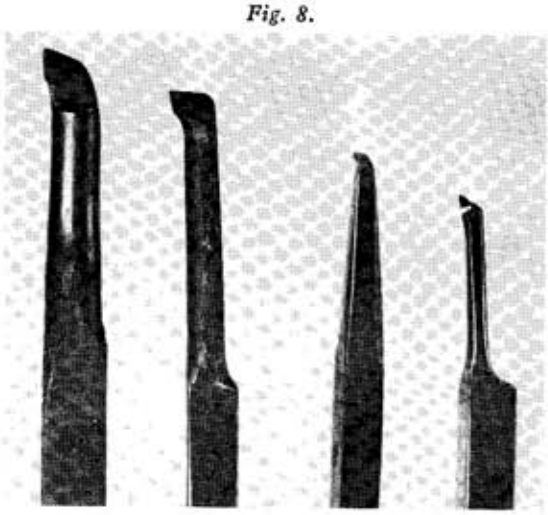
The tool points for internal work are much the same as those that have already been described, but in this case the points are grafted on to stalks or bars so they may enter the part being machined.

The boring tool

Commercially made boring tools are, for the most part, a one-piece production. A group of these tools are seen in Fig. 8. They are well adapted to work of either large or small dimensions. As will be observed, the points bear a strong resemblance to that of the knife tool, in fact the shape and angles used are, for the most part, those of a left-hand knife tool with a roughing tool variant similar to that already illustrated in Fig. 2. The two forms of tool points are illustrated in Fig. 7.

The front clearance is usually about 10 deg. and the top and side rake varies from zero in tools for use on brass to 15 deg. for those to be employed on light alloys. In addition extra clearance has often to be provided as shown in Fig. 9 or the boring tool will not enter the work. From this illustration it will be evident that, as seen at A, the boring tool will just about clear the work whilst as at B it will not enter unless a considerable portion of the underside of the tool is removed. The position of the cutting edge is somewhat above the centre line as a preventive measure against "digging-in." This placing is satisfactory for parallel boring but not for machining tapers when the tool must be set truly central.

Fig. 8.



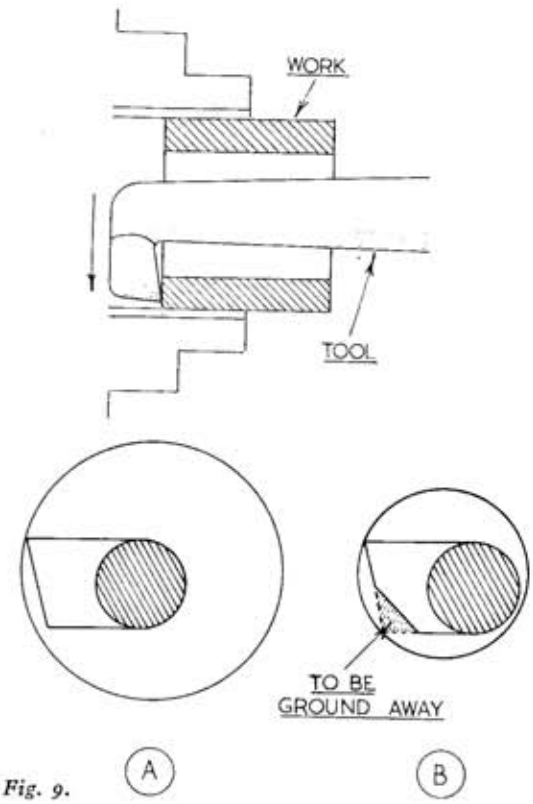


Fig. 9.

The undercutting tool

It is sometimes essential to provide clearance at the bottom of a blind bored hole. This can be achieved by the undercutting tool shown in Fig. 10. The form of this tool is the same as that of the parting tool already described. The width of the cutting edge should be kept as small as possible consistent with strength, at any rate for light lathes, because it is always possible to make two or more cuts to produce the degree of axial clearance needed.

The threading tool

A tool for internal screw cutting is also depicted in Fig. 10. Here, again, the point follows the form used for external work having the same clearance and rake angles as the external tool, and as with this tool also requires to have its point set on the centre line. As before, the gauge previously illustrated is used to check and set the toolpoint.

The back facing tool

A type of boring tool that needs to be better known is that used for facing work inside the chuck.

The point is similar to that of a normal boring tool but is ground so that it cuts on the back face only. Obviously, the area of work that can be

covered in this way is small. But the facility is sometimes needed and should be noted, though the back facing tool is not amongst those that are absolutely essential. It is shown in Fig. 10 whilst its employment is depicted in Fig. 9.

Clearly the tool point must not be brought into contact with the chuck jaws, so the small area left unmachined would need to be cleared by a subsequent chamfering operation.

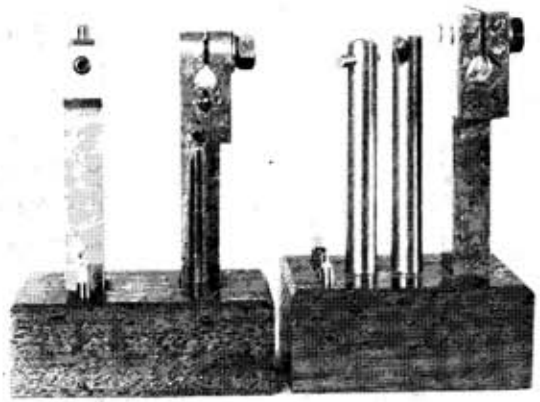
Tool holders

In order to accept the high-speed steel tool bits mentioned previously, there are specially produced holders available. A typical example is that made by "Eclipse" to take square section tools and illustrated in Fig. 11. In addition the same firm supply holders to serve as mountings for their straight-sided and hollow-ground parting tools. These need to be secured rigidly and to be easily and rapidly adjusted in relation to the amount of their "stand out" from the tool holder.

Tool holders to take small cutters for boring operations are readily made in the private workshop. A group of these is illustrated in Fig. 12.

The tools shown are of the type designed to take small cutters made from circular section material, but the holders will also accept one-piece boring tools similar to that illustrated in Fig. 13.

Above : Fig. 11.



Below : Fig. 12.

The Myford patented lathe tools

The special turning tools developed by Myford Ltd. are of particular interest in that in order to raise the tool point to lathe centre height they do away with the need for packing. This is brought about by mounting the shank of the tool in a "boat" having a convex seating. The shank itself is correspondingly curved, so that by sliding the tool either backwards or forwards, its point can be raised or lowered at will. Once the correct setting has been found, the tool is clamped under the tool-post. The arrangement of the Myford device is shown in Fig. 15. In order to demonstrate the system the tool placing has been deliberately exaggerated. In fact the dimensions of the parts have been selected so that, in the lathes for which these tools have been designed, the rake angles of the tool point are not unduly affected.

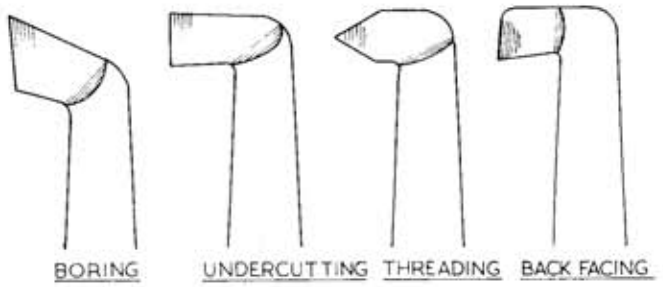


Fig. 10.

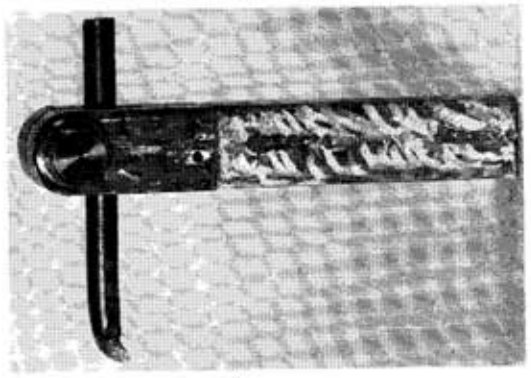


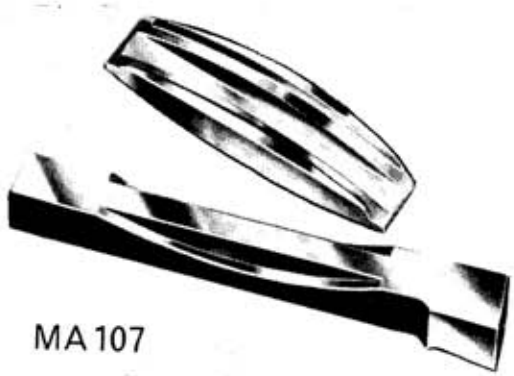
Fig. 13.

Carbide tipped tools

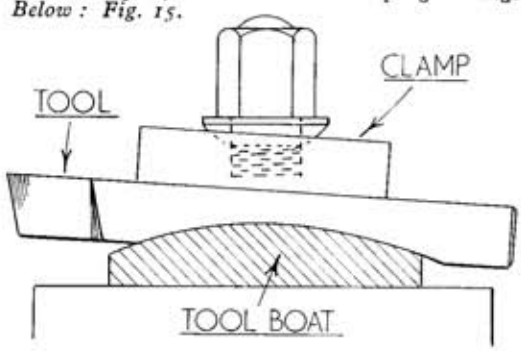
A group of these tools is illustrated in Fig. 16. They have been consistently employed on cast-iron, a material that does not affect the carbide tips, and can be relied upon to deal effectively with any hard spots in the castings themselves. In the illustration A and B are right-hand and left-hand off-set tools respectively. C is a roughing tool and D a round nosed tool for use both on bar work and castings. The tool indicated at E is a right-hand knife tool similar to that in Fig. 3 and is principally used on cast-iron bar.

Grinding equipment

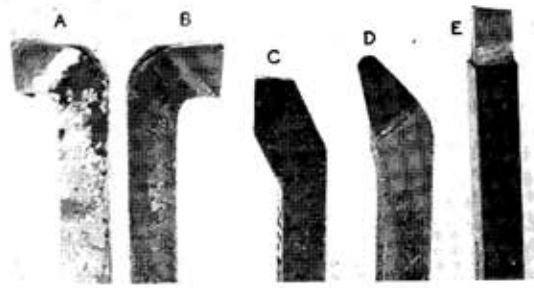
It will be apparent that lathe tools, or indeed any other cutting tool, will not retain a keen edge indefinitely. It is necessary, therefore, to provide



Above : Fig. 14.
Below : Fig. 15.



Top right : Fig. 16.



equipment, however simple, that will enable the grinding of tools to be carried out.

The most convenient machine for the purpose is an electric grinder usually having two wheels, one of coarse grit, the other fine, and a pair of rests to support the tools to be sharpened.

It is sometimes suggested that grinding should take place at the wheel's periphery. But unless the wheel is of large diameter, the tool itself will be needlessly hollow-ground. It is best therefore to grind on the side of the wheel when the resulting faces of the tool will be straight-sided and the tool's edge not weakend by hollow grinding.

Grinding on the side of the wheel requires a machine spindle without end float. Unfortunately, self-contained grinders of quality are expensive. The one reasonably-priced machine designed specifically for the amateur appears to have considerable end float, though it has been possible, by a simple modification, to remove this. In the main, therefore, the employment of a grinding spindle driven by an independent electric motor is the best solution to the problem.

The tool rest conventionally supplied with commercial grinders has a surface at right-angles to the side of the wheel. It follows that only the skill of the operator will ensure that the tool angles ground are approximately correct. In a large engineering works the general machinists are usually adept enough to grind tools of sufficient accuracy free hand, but the tool room is called on to treat expensive carbide tipped tools whose angles are somewhat critical. An angular grinding rest is used for this purpose, so the provision of a simple device enabling the amateur to ensure correct angularity is fully justified both by precedent and practice.

A simple angular tool rest is easily contrived from material commonly found in the scrap box. All that is needed is a piece of material to form the table A, a short length of rectangular bar for the upright arm B, and some angle iron to serve as an anchorage C, either to the bench or to the grinding machine itself. A second short length of angle iron forms the support for the work table D in the manner shown by the illustration Fig. 17 (see next issue) where the few simple parts of the device are shown.

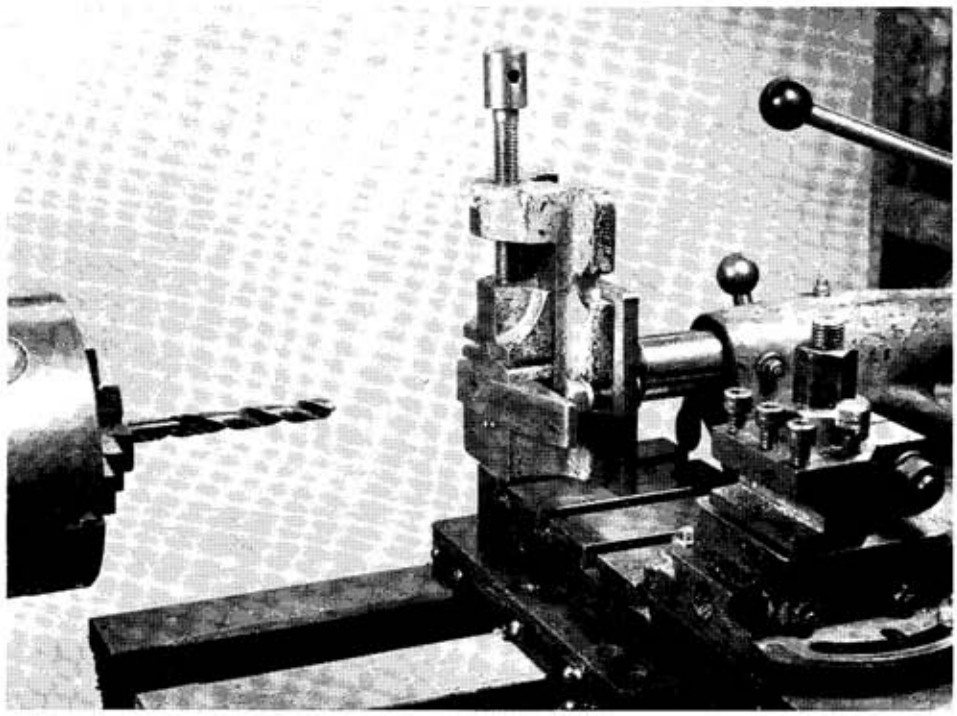
It is, of course, perfectly possible to elaborate on this conception. Indeed, its adaptation to existing machines will certainly call for this. It is almost impossible to give details of a device that will suit all forms of grinding machine.

Setting the angular rest

It is not always easy to adjust the angle of the rest using a protractor for the purpose as the latter may easily foul any wheel guards that may be in place. It is best, therefore, to use a simple template of the type shown in Fig. 17. One or more of these are readily made from brass sheet, cut to the angles most commonly needed, and mounted on a base so that they may be set on the tool rest and applied to the side of the wheel. In this way rapid setting of the correct angle can be achieved without difficulty.

An alternative form of the simple angular tool rest is illustrated in Fig. 19 (see next issue). This rest is divided so that its individual tables can be tilted to permit grinding to be carried out on either side of the wheel without having to re-set the rest each time a change of side is necessary. Little comment is needed to explain the workings of the double rest as this will be evident from the illustration. It follows the principal details of the simple angular rest with the addition of a cross bar on which to mount the separate tables.

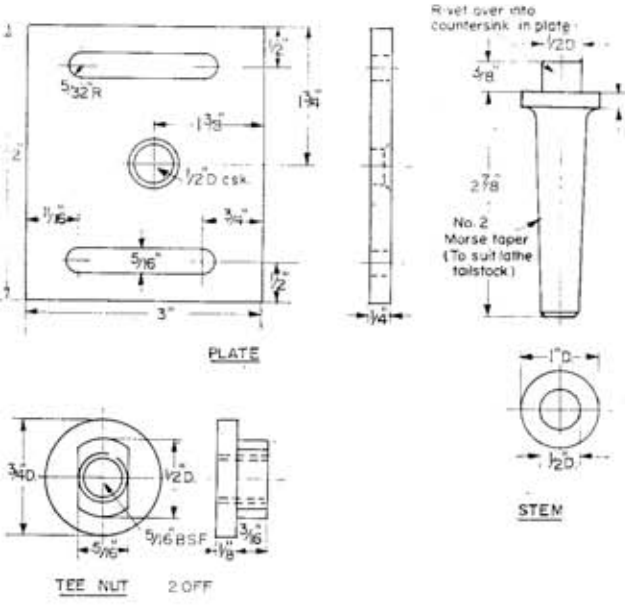
To be continued.



Drilling a truly positioned hole in the lathe, using the machine vice on the tailstock adaptor.

Accurate Drilling in the Lathe

By L. C. Mason



THOSE PEOPLE who do all their drilling in the lathe, using a drill held in the three-jaw chuck, will have found that it is not always easy to hold a piece firmly and safely for accurate drilling.

Something better than resting the piece against the end of the tailstack barrel is needed, and at no time is it a good idea merely to hold the job in the fingers. The larger the drill involved, the more dangerous does this become. The accessory shown enables the Myford machine vice to be used for this, with all the advantages given by a power bench drill and possibly greater rigidity.

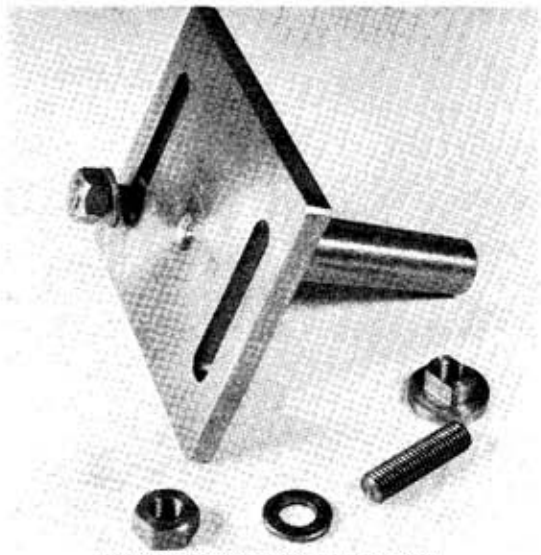
The fixture enables the vice to be mounted absolutely squarely to the chuck, and owing to the plate being unsymmetrical, any point on a job up to the maximum size that can be held in the vice can be brought on to the centre-line, either by sliding the vice up or down on the plate, turning the job round in the vice, or a combination of both.

The mounting plate is a piece of ¾ in. mild steel plate, squared up to 3 in. × 3½ in. Mark it out for the various holes, but drill only the centre one for the taper stem for the time being. This can be done either in the four-jaw chuck or with the plate clipped to the faceplate. Countersink the marked

out side just enough to remove all burrs, and the other side distinctly deeper, enough to provide a firm fixture for the riveted-over end of the taper stem.

The stem is turned from 1 in. round mild steel, making the taper an accurate fit for the No. 2 Morse taper of the ML 7 tailstock socket, or to fit whatever other tailstock it is to be used in. Setting the topslide over about 1½ deg. will not be far out for rough turning the taper for a start, and the finishing cuts will have to be largely trial and error in obtaining a close fit. Remember that a minute alteration to the top-slide angle will make a big difference to the fit of so gradual a taper. Aim for a finished fit when about 1¼ in. protrudes from the tailstock when it is plugged firmly in, although this dimension is not at all critical. Turn a generous chamfer on the small end of the piece.

Transfer the taper stem to the headstock socket and turn down the outer ⅜ in. to ½ in. dia., making it a tight push fit in the central hole in the plate. Fit it in the plate with the deep countersink outwards, and the slot markings on the stem side of the plate. Resting the small end of the stem on something really solid, rivet the protruding stub of ½ in. stem tightly down into the countersink in the face of the plate. Check that the hammering has not burred over the chamfer on the small end of the stem, and replace the job in the headstock socket. With a keen slightly rounded tool, face back the irregular centre riveting and face very lightly over the whole face of the plate. This ensures that the face of the plate is really square with the lathe axis, and gives a better surface on machining than if the slots had been cut before facing.



Tailstock drilling fixture complete.

All that remains is to drill the holes at the ends of the slots, and saw and file out the slots to the marked lines, removing any burrs that may be thrown up.

Mounting and handling the vice on the plate is made somewhat easier by the provision of a couple of T-nuts, engaging the slots at the back of the plate. These can be made from a stub of ¾ in. round mild steel, milling or filing the flats to an easy fit in the plate slots.

A 1⅛ in. length of ⅜ in. BSF studding for each, with normal nuts and washers on the front to engage the slots of the vice base completes the job.

M.E. TRACTION ENGINE

Continued from page 842

groove is about ⅛ in. deep. Now dig out the mandrel dividing gadget that has been used for lots of previous jobs and divide round the wheel for 30 divisions. Scribe these points in across the thickness of the wheel, or else lightly plane in the start of a tooth at each station with the parting tool laid sideways. Watch which way the teeth come; the sloping side is arranged to provide a clockwise rotation looking at the face of the wheel when fitted up on the pump. This has to be so, as the wheel is in effect screwed on the end of the shaft.

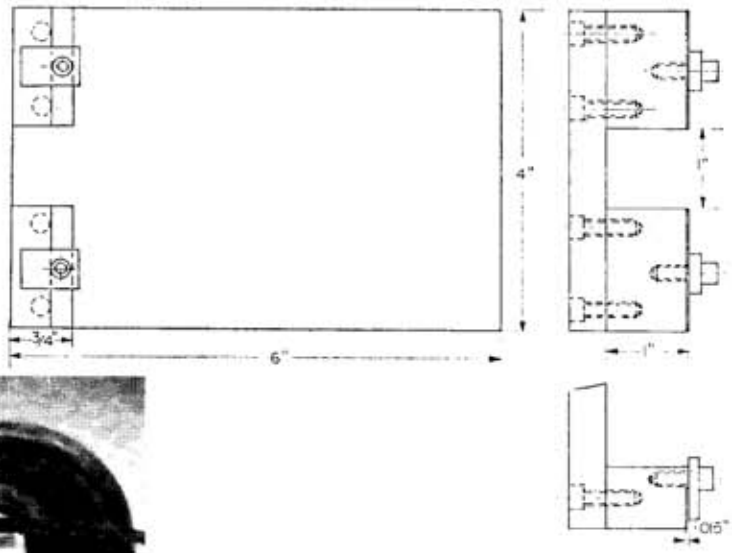
Thirty teeth were mentioned for the ratchet wheel; this is about the minimum number that ensures a tooth being picked up at each swing of the ratchet lever. A larger number could be cut if preferred, picking up more than one tooth of a smaller size at each full swing. This could be utilised to make sure that the pump still functioned when the swing of the ratchet arm was reduced on notching up, as the arm is driven from the valve rod. With 30 teeth, the maximum swing is slightly more than just one tooth, though not enough to gather two. This still gives one tooth movement on a slightly reduced swing.

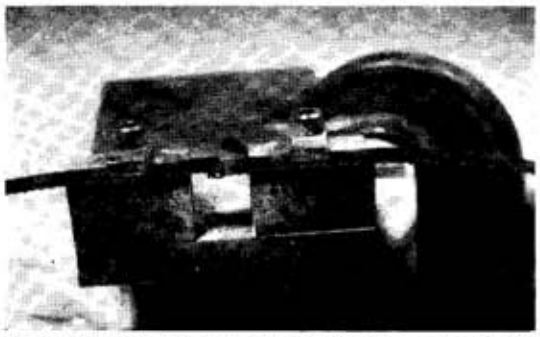
When all the teeth positions are clearly marked, part right off, re-chuck lightly by the ⅜ in. dia. collar and face up cleanly to thickness. The teeth can then be filed in by hand with a thin triangular file. After facing, there should be a 3/32 in. thickness left drilled with the No. 50. Tap this 8 BA and harden right out by heating the wheel to a brightish red and quenching in water.

A short length of 8 BA studding in the end of the eccentric shaft enables the wheel to be screwed in position, where it is locked by the hand-crank. The handles for this are cut-down cabinet pins with the heads rounded off, and soldered into an oval bar tapped 8 BA in the centre to serve as the locknut for the ratchet wheel.

A Jig for Joining Band-Saw Blades

By A. Mackintosh





BAND CUT-OFF SAWS are coming into increasing use among amateurs. I have one which has a capacity of 4 in. × 6 in. and which is considerably quicker and more accurate than my old reciprocating saw. It takes 64¾ in. long blades which the manufacturers say are "standard" but which I have been unable to buy except from them, and which become very expensive when mailing charges have been added to the original cost.

I have access to an electrical bandsaw butt welder but have had little success with it because I don't seem to be able to get the annealing right and the blades part as soon as tension is put on them—besides, a bandsaw welder is too expensive a gadget to have in my own shop. A solution to this difficulty is to silver solder the blades, and the jig described allows me to do the job right every time and, properly soldered, the blades do not part.

The base is a piece of aluminium plate, 6 in. × 4 in. and ½ in. thick. Two pieces of aluminium 1½ in. × 1 in. × ¾ in. are screwed to this as shown and a milled cut .015 in. deep and ½ in. wide is taken across the top (this can be done in the lathe). The jig is completed with a couple of screw clamps made out of ⅛ in. × ½ in. aluminium. Ten-32 cap screws were used throughout in my jig, but whatever happens to be on hand is suitable.

I now buy my bandsaw blading in 100 ft. rolls. The method of making up a saw is to cut off a 65 in. length and scarfe the ends with the grinding wheel to a depth of about three teeth. One end is then clamped in the jig, using the milled cut as a guide; both ends are then fluxed and the other end clamped in the other side, putting a ½ in. length of 1/16 in. soldering wire between the scarfed ends—the spring of the blade holds the wire firmly. The blade is then heated at the join with a propane torch until the solder has flowed freely. Excess solder is then ground off and the blade is ready for business.

I find that this method reduces the cost of blades to about 1/3rd that of made-up blades.

JEYNES' CORNER

Continued from page 866

signals I noticed are already in position. Between the Central Station and the running shed is a turntable transhipper, at present in skeleton form; this gives access to the two roads in the locomotive running shed, a siding beside the locomotive shed, and to a line some 100 yards long, almost at right-angles to the main line, leading to the works departments of repair shop and wagon shop.

Mr Tate has secured many signals, signs, ground signals, etc., of North Eastern Railway origin, so his railway has a legitimate claim to the title of North Eastern Railway.

I noticed that drainage had not been forgotten, also that Old Mother Nature has been very busy on the line, and had made very effective efforts to cover up the scars made by cuttings, etc., and Mr Tate remarked that he would soon have to rig up a weed killing wagon to deal with the rapid growth of weeds on the permanent way.

The line is laid with flat bottom rail throughout, which is of course really out of scale, but it is of a robustness which will add safety in operation, as well as much greater durability. I am looking forward to seeing his railway in operation, as it will be so different than just running about 50 yards or so, and all the staff are enthusiasts, so there will be no possibility of passengers getting strike-bound.

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

Electric traction

SIR,—In his letter to Postbag of M.E. No. 3395, Mr Randall states he would like to use car batteries to power his 10½ in. garden railway. I wonder if he has considered a diesel-electric locomotive as an alternative ?

For the heavy current which would be demanded by the traction motors the battery ampere-hour capacity would be appreciably below that for a battery discharged at the usually stated ten hour rate. The discharge of the battery would be accompanied by a fall of terminal voltage with a corresponding loss of power of the traction motors.

In the use of batteries the most suitable system to employ would be the one of " Series-Parallel " control as described by Mr F. L. Davies in the *Model Engineer*. This would result in all cells of the battery being discharged an equal amount. Although a graduated starting and accelerating current may be obtained by means of cell tappings, this results in the uneven discharge of cells with difficulty in balancing their recharge.

Whilst no-one could be more qualified than Mr Davies to prepare designs for the traction motors of the garden railway the question may well be asked whether his commitments would permit him to devote the time necessary for the calculations involved, and the preparation of drawings. Would this work be justified, in any case, for what could well be a one-off demand only ?

I can appreciate the problem with which Mr Randall is faced in the supply of motors for his proposition. I wonder if he has thought of using redundant car dynamos as traction motors, as other M.E. contributors have done ? Without having given much thought to the matter, I have in mind a scheme whereby four such units could be employed, one pair in tandem driving the leading bogie and the other pair the trailing bogie. The motor connections would be arranged for series-parallel control with further increase of speed by diverter resistances across their field windings.

I should be pleased to discuss the foregoing with Mr Randall. I note that he gives Ashford for his address. I should be pleased to meet him, by arrangement at Sidcup or possibly he would come along to one of the events my Society has in the Kent area.

Sidcup. A. E. MOUNT.

Steam car engines

SIR,—Some little time ago when writing to Mr Westbury, whom I was sorry to learn is no longer with us, I mentioned that I had an old steam car engine under reconditioning, but that I was doubtful as to the name of the maker.

Recently I was confined to bed with this peculiar Hong Kong 'flu and when I started to take an interest in things again passed away the time by looking through old copies of the M.E. In Vol. 111, No. 2780 is a letter and photograph from Mr J. Bamford of the Aldershot M.E. Society referring to an early steam car engine. In Vol. 133, No. 3317 on the opening page of " Smoke Rings " is a photograph of a steam car engine built for William Crawshay, the Iron Master of Merthyr Tydfil. Cylinders 3 in. bore x 3½ in. stroke.

This letter and photographs are most interesting as the two engines are of the same make as my own. The one referred to by Mr Bamford, it would appear, is identical in size with my own. The frame castings on the Crawshay and smaller engines are identical in design. The feed pump on the Crawshay engine is the same as mine, but is missing on the Bamford engine although the cast-on bracket for carrying the pump is present.

The larger engine would appear to have ball bearing big ends, whereas on the smaller, mine and the Bamford, they are of white metal as are the split main bearings. Crossheads are cast iron with a circular form thrust face sliding in hardened steel screwed on guides.

I know a number of makers of steam car engines, but as mentioned previously, the maker of these three engines leaves me in doubt. I wonder if you or any reader could enlighten me on this point; the engine is nicely made with all eccentrics and straps polished and glass hard.

Prior to coming into my possession, my engine had for a number of years been operated on compressed air, chain driving a reasonably large lathe in the workshop of an old established engineering shop in Cape Town.

I also have another engine I saved from being broken up for scrap. This engine is a horizontal 2½ in. bore × 5 in. stroke and, I believe, worked for some time in Simonstown. I have started reconditioning this, it has obviously done some hard work, but is anything but worn out. Again, the maker's name does not appear on the engine.

Any information readers can give regarding the steam car engine would be appreciated.

Florida North, Transvaal. R. HOLMES.

Boiler testing

SIR,—A few days after reading the letter of Mr Proudlock in M.E. June 5, I read in our local newspaper of the bursting of a motor coach tyre.

The coach was being taken out of service because of a suspected brake fault and was proceeding slowly to a depot for attention. In fact a wheel bearing had seized and pressure in the tyre built up till it finally exploded.

The newspaper stated that Mr Malcolm Fordyce of Fordyce Commercial Vehicles Ltd., who had examined the coach and was following behind in another vehicle when the tyre burst said, " The explosion was violent. I reckon if anyone had been standing near the tyre they would have been killed. It went off like a bomb."

This explosion resulted in the breaking of 27 windows in six houses, one window being shattered like a car windscreen. Fortunately no one was injured.

There is no way of knowing what was the pressure in the tyre just before it burst, but the effect of it was far from innocuous and the incident adds weight to the final paragraph of Mr Proudlock's letter.

Englefield Green, Surrey. FRANK L. WOODGATE.

BOILER-MAKING TODAY

Continued from page 870

of copper hammered to the size required. Solder with Easyflo.

The last job is to fit the smokebox tubeplate along with any necessary bushes to go in the tubeplate. We must mention at this point that we always follow modern practice and fit bushes to all holes in a boiler. Fittings screwed directly to boiler plates are a source of failure and danger. Any excess lengths of stays are now cut off and filed almost flush.

Hydraulic testing can be a messy business. Most workshops are not equipped with running water and the continuous to-ing and fro-ing in and out of the kitchen with dripping boilers, bowls of water and muddy feet are not conducive to matrimonial bliss ! Also, you may not have a suitable hand pump. The following method, for which we do not claim any originality, goes a long way to minimising the mess.

Make and fit plugs to all the holes, one of which is adapted to take a pressure gauge. Fill the boiler completely with cold water, making certain that no air remains inside, attach the pressure gauge which should be of a large, tested type and apply heat to the boiler using your blow torch. The water will soon expand and the pressure will rise or any leak will become apparent. At no time should the water need to be more than warm. It will be realised that expanding the almost incompressible water by a little heating is just as satisfactory a method of applying hydraulic pressure as the conventional method of pumping in extra water. It is usual to test to twice working pressure. Some slight movement of the plates can be expected as they settle to take the strain.

You now have a first-rate boiler and we are sure that you will have had a more pleasant time in the building and will have a happier time in the future running of your boiler in the knowledge that you have no soft solder to melt, should your boiler in the hands of an inexperienced novice be allowed to go low on water.

In conclusion, we must add that we will be happy to receive comments and suggestions for any further improvements. ▣

CLUB DIARY

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

September 4 East Sussex Model Engineers. Talk by Frank Daws at Mercatoria. 7.45 p.m.

September 4 Romford MEC. Meeting to be held at: Ardleigh House Community Association, 42 Ardleigh Green Road, Hornchurch, Essex. Competition night at 8 p.m.

September 4 Model Engineers' Society (N. Ireland). Radio Control of Models, Mr Terence Bell. Transport Museum, Witham Street, Belfast. 7.45 p.m.

September 4 Stockport SME. "Bits and Pieces," Wellington House, Wellington Road, Heaton Moor. 7.45 p.m.

September 5 Northern Ireland MES. Clandeboye Garden Fete. Venue Clandeboye Estate.

September 5 Brighouse & Halifax SMEE. Public open day. Ravensprings Park, Cawcliffe Road, Brighouse.

September 5/6 Huddersfield SME. Open weekend at Highfield, ¼ mile from centre of Huddersfield. Open competitions—miniature locomotive track in operation.

September 5/6 National Traction Engine Club. Rally at Burbage, Hinckley, Leics. Details from J. Cooper: 1 Cedar Road, Earl Shilton, Leicestershire.

September 6 Cheltenham Society of Model Engineers. Public open day, Hatherley Lane (near Arle Court), Cheltenham, Glos. 2.30-6 p.m. Rides on the miniature railway, radio control boat demonstrations. Light refreshments available.

September 6 Birmingham SME. Northampton SME open day.

September 5/6 National Traction Engine Club. Rally at Stoke Poges, near Slough, Bucks. Details from W. J. Arnott Brown, 70 Northdene, Birtley, Co. Durham.

September 5/6 National Traction Engine Club. Rally at Horsham, Sussex. Details from B. Johnson, 24 Sheridan Road, Worthing, Sussex.

September 5/6 National Traction Engine Club. Rally at: Denham Green Lane, Denham, Bucks. Details from: W. J. Arnott Brown, 70 Northdene, Birtley, Co. Durham.

September 6 Sussex MLS. Visit by Harrow & Wembley Society to Haywards Heath.

September 5-6-7 Pennsylvania Live Steamers, Inc. Fall meet. Details: William H. Scott, R.D.I., Box 400, Sellersville, Pa. 18960.

September 6 Northampton SME. 2nd annual rally. Delapre Park, London Road, Northampton. 11 a.m.

September 6 Guildford MES. Running day for members and friends at Headquarters, Stoke Park.

September 6 Malden & District SME. Public track day.

September 6 Colchester SMEE. Invitation Day. Clubhouse, Old Allotments, Lexden. 10 a.m.

September 6 Sunderland MES. Visit to TSMEE. 2½, 3½ & 5 in. g. track. Exhibition Park, Newcastle.

September 6 York City & District SME. Public running day. Track at: Moor Lane, Dringhouses, York.

September 8 Sutton Coldfield & N. Birmingham MES. Open night. 286 Brookvale Road, Birmingham 23. 7.30 p.m.

September 9 Northern Mill Engine Society. Meeting at the Spread Eagle Hotel, Cheetham Street, Rochdale, at 8 p.m.

September 12 The Gauge 1 Model Railway Assoc. Get together with Mr & Mrs. E. C. Griffith, 8 Mavins Road, Farnham, Surrey. Commence 2 p.m.

September 12 Northolt Model Railway Club. Club annual exhibition, 1.30 p.m.-6.30 p.m. Northolt Village Community Centre, Ealing Road, Northolt, Greenford, Middlesex.

September 12 The Society of Model and Experimental Engineers. Rummage sale —followed by special general meeting, at Marshall House, 28 Wanless Road, London S.E.24. 5.30 p.m.

September 12 Bristol SMEE. Public running at Canford Park. 3-7 p.m.

September 12-13 Iowa Model Steam Engineers. Steam meet. Details: Pershing G. Scott, R.F.D.I., Marion, Iowa 52302.

September 12/13 Andover and District MES. Steam rally at Finkley Manor Farm, Nr. Andover. Miniature railway, exhibition of general engineering models and galloping horse roundabout.

September 12-13 Golden Gate Live Steamers. Steam meet. Details: Joe Bryan, 1225, Scott Street, El Cerrito, California, 94530.

September 13 GEC (Coventry) Model Engineering Society. "Open Day"—GEC Sportsfield, Brindle Avenue, Copsewood, Coventry. 3½" and 5" gauge. Refreshments available. 10.30 a.m.

September 13 Birmingham SME. GEC (Coventry) MES open day.

September 13 Hull SME. Annual visit to Temple Newsam.

September 13 Sunderland MES. Visit to York MES, 2½, 3½ and 5" g. track. Bus trip.

September 13 Malden & District SME. Working party.

September 15 Chesterfield & District MES. Bryan Donkins Canteen at 7.30 p.m. "Derbyshire Industrial Archaeology," Philip Ridden.

September 16 Bristol SMEE. Petrol engine locomotives. Mr Canulda will talk about his locomotive that performed so well at our exhibition last year.

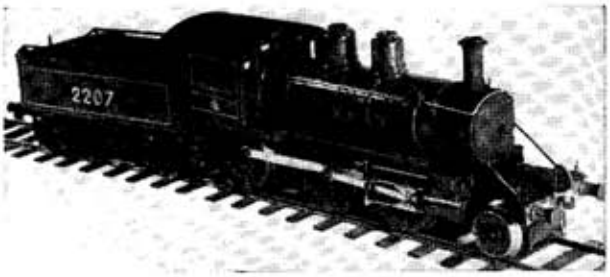
September 17 Nottingham Society of Model & Experimental Engineers. Ladies' night. Illustrated talk by Tony Brooks Esq. Subject: Chocolate, Cheese & Co-Co's. Some impressions of Switzerland. 7.30 p.m. Friends' Meeting House, Clarendon Street.

September 18 Rochdale SMEE. Running at track. Springfield Park, Rochdale, Lancashire.

September 18 Romford MEC. Meeting to be held at: Ardleigh House Community Association, 42 Ardleigh Green Road, Hornchurch, Essex. Talk and films by an official of the North Thames Gas Board—at 8 p.m.

September 18 Stockport SME. "Mystery Night," Wellington House, Wellington Road, Heaton Moor. 7.45 p.m.

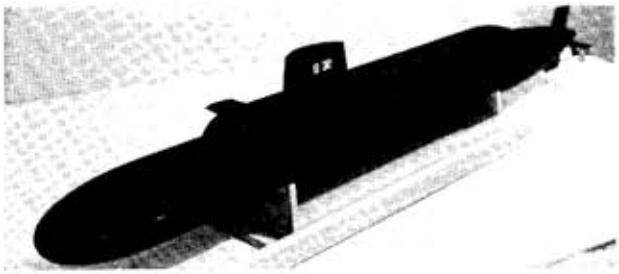
September 18-20 National Traction Engine Club. Rally at Stourpaine Bushes, Dorset. Details from M. F. Oliver, Dairy Mead, Child Okeford, Blandford Forum, Dorset.



Picture shows Martin Barradell's Midland Railway Baldwin 2-6-0. Model is O gauge, cunningly converted from Rivarossi "Casey Jones." Other articles in October include John Flann on 4 mm. scale bridge building, Martin Waters on Great Central track layouts, and Peter Randall's coverage of the good old pre-war Hornby tinplate "Atlantics." Prototype information includes the Wrinton Vale Light Railway and four pages of rare photographs in "Photospot."

Model Railway News

October issue on sale September 11th



A very bright cover features a scale sailing barque and its owner, and inside, there are two more pictures and some notes on the model's construction. Yacht construction notes, photos, and sketches continue the valuable series on various ways of building a yacht.

Power-wise, the chief item is a fast steering boat, *Sharpshooter*, for modern R/C competition. Only 22¾ ins. in length, this model is for 1½-3½ cc engines and should prove a very popular plan. Electric boats, very much up and coming, are dealt with in their own new series, which this month includes details of all boats entered at the first-ever all-electric regatta, successfully held by the Mortlake club.

A radio-controlled submarine should interest many readers; subs seem to hold a special fascination. For detail enthusiasts there are articles on warship anchors, the German WWI warships *Goeben* and *Breslau* (the *Goeben* still survives as the Turkish ship *Yavuz*), plus a modern merchantman. There are readers' models, motor reports, picking a first boat for competition running, regatta reports, etc., etc.

Model Boats

OUT NOW
PRICE 3/-

CLASSIFIED ADVERTISEMENTS

Private: 4d. per word. Trade: 8d. per word. Minimum 12 words. Use of Box Number 2s. 0d. extra. Display Classified Advertisements: 40s. per single column inch. (Column width 2 in.) Full particulars on application. Receipts are only issued for orders of 20s. or over. Advertisements, with remittance, should be sent to Classified Department, MODEL ENGINEER, 13/35 Bridge Street, Hemel Hempstead, Herts., at least four weeks before issue.

The Advertisement Manager reserves the right to refuse or suspend advertisements without giving any reason. Every care is taken to avoid mistakes, but the publishers cannot be held liable in any way for clerical and printing errors or omissions. Reciept of " copy " for publication implies acceptance of these conditions by the advertiser. Whilst every care is taken to exclude advertisements from doubtful sources, no responsibility can be accepted by the publishers for the bona fides of advertisers.

WORKSHOP EQUIPMENT

PORTASS LATHES

3½" to 5½" centres, from **£43** to **£350.** Come direct and secure personal service. Stamp for lists please.

CHARLES PORTASS & SON
Dept. M.E., BUTTERMERE WORKS SHEFFIELD 8 *Est* 1889

Wanted. Myford ML7, ML7B, or Super-7. Will collect Southern England.—261 Romsey Road, Old Shirley, Southampton. MN

Plain Horizontal milling machine table 20" × 5" auto feed, suds pump. No motor, £25. Buyer collects.—F. HIGGINS, 1 Peters Wood Hill, Ware, Herts. Phone: 3269. M

NEW MYFORD LATHES SPARES & ACCESSORIES

NEW BOXFORD & PERFECTO LATHES, KENNEDY HACKSAWS, BANDSAWS, DRILLING MACHINES etc.

WE SPECIALISE IN PART EXCHANGES OF ALL TYPES OF SMALL MACHINES AND TOOLS AND CAN USUALLY OFFER A GOOD AND VARIED SELECTION

WE ARE ALWAYS WILLING TO PURCHASE COMPLETE WORKSHOPS OR SINGLE MACHINES

NOW IN STOCK IS A GOOD RANGE OF BRASS, COPPER, STEEL, SILVER STEEL, NUTS & BOLTS, TAPS & DIES, ETC.

CREDIT FACILITIES AVAILABLE

E. N. MOLE & CO. LTD.
3 TOLPITS LANE, WATFORD. Tel. 43135

Just Beginning ? Then read this: E.W. 2½" lathe; four-jaw chuck (worn, but serviceable); tailstock chucks; 0-¼" and 0-5/32"; complete set change wheels; faceplate; T-slot cross-slide; standard cross-slide and top-slide (top-slide really requires new base (drawings available) vertical T-slot slide; lead-screw fitted dog clutch; motorised toolpost milling/drilling spindle (0-5/32" chuck); home-built collet set; countershaft; ¼ h.p. motor. M.E. type bench drilling machine, 0-¼" chuck; countershaft; ¼ h.p. motor. Bench grinder (crude, but works); ¼ h.p. motor. New 0-1" Starret micrometer. Plus odd vices, tools, materials, etc. £35 o.n.o. Will deliver up to 75 miles. Write first to—R. T. COX, 57 Orsett Road, Grays, Essex. M

CANADIAN SUPPLIER

OF—Lathes and Accessories, Tools, Taps, Dies, Reamers, Drills and Magnetics.
BY—Myford, Eclipse, Warrior, Dormer and Summit.
E.K.S. & Co. Phone: Don Sibley
1828 PITT RIVER RD. 942-4384
PORT COQUITLAM
B.C., CANADA Area Code 604

ELECTRIC ENGRAVING SET Works off mains
20 DIFFERENT TOOLS INCLUDED!
£7.19.6 COMPLETE

A wonderful **complete** set of TWENTY assorted engraving & cutting tools PLUS oilstone PLUS electrically operated power VIBRATOR PLUS handsome fitted case. Engraves designs, numbers, names, symbols, letters, etc., as you will onto hard surfaces like metal, glass, porcelain, plastics, leather or wood. Cuts stencils, gaskets, cork, felt, paper, card, lino, embosses and hammers leather. Ideal for hobbies, professional intricate work, stylists, engineers, etc. With instructions. While stocks last. **Only £7.19.6** + 7/6 P. & P. Send **£8.7.0.**

JOHN DUDLEY & CO. LTD., Dept. ME2
196 Finchley Road, London, N.W.3
Tel.: 01-794 7318

Wanted. Travelling steady for Myford 3½ M type lathe.—BENFIELD, 18 Abberbury Road, Iffley, Oxford. Phone: 78346. M

Wanted. Unimat lathe with accessories.—A. C. BRUTON, 93 Thirlmere Gardens, Wembley, Middlesex. M

DORE-WESTBURY LIGHT VERTICAL MILLING MACHINE

Every piece of material needed is supplied, not just the main structure castings, and all operations are done which would be difficult or impossible in the normal home workshop. 3½" lathe and drill will complete. Delivery from stock. S.A. foolscap envelope please for illustrated leaflet.

DORE ENGINEERING
1 DRURY LANE, DORE
SHEFFIELD S17 3GG

Tel: 362307

Visitors by appointment only, please.

Grayson Lathe 3½" × 20", many extras, seen working. Offers or part exchange for 1 h.p., single-phase, 1,425 r.p.m. motor.—32 Farmway, Braunstone, Leicester. M

Wanted. Vertical slide for watchmaker's 8 mm. lathe; or lathe complete with compound slide and vertical.—PASS, 17 Park Road, Haslington, Crewe A157. KLM

Wanted. Myford lathe, will pay cash and can collect.—01-654 1423. 91 The Glade, Shirley, Croydon, Surrey. KLMN

Lathe Milling and Grinding attachments, saw tables, tailstock turrets, drill grinding jigs. List 1s.—G. POTTS, Troutbeck, Windermere. ALT T/C

PERFECTO

5" and 7" Hand and Power Shaping Machines. 3½" × 16" B.G.S.C. Centre Lathes. 3" Machine Vices. 6" × 12" Universal Cutter Grinder.
Stamp for lists.
PERFECTO ENGINEERING CO. LTD.
Claymill Rd., Barkby Rd., Leicester.
Phone: 768384. T/C

CLERKENWELL SCREWS LTD.
107/9 CLERKENWELL RD., LONDON, EC1. 405. 6504 & 1215
Welcome your enquiries for Brass and Steel Screws, Nuts and Washers, 0-8 BA in Rolled and Turned, also 10-12 BA in Turned. Whitworth and B.S.F. in Rolled Threads only. All Heads. (Minimum one gross any one item). Goods sent C.O.D. Post or on Payment of Pro-Forma invoice. 24-hour service for stock items. **Send for Lists.**

You Should See My Cat! It has 5,000 interesting items: mechanical and electrical gear and materials. Send S.A.E. today to—K. R. WHISTON, Dept. M.E., New Mills, Stockport. Z-M

Myford, Perfecto, Flexispeed, Perris and Unimat lathes and accessories. Quotations for machining wheels, castings, etc.—G. M. H. BUNCE & Co. LTD., 206 West Street, Fareham (4136). T/C

SAVE £££'s ON NEW LUXURY TOOLS..

All with maker's guarantee

Prompt despatch. Orders to the NETT value of £20, and over, post free in U.K. Overseas rates on request. Money refund guarantee. We have thousands of delighted customers.

BLACK & DECKER	List price	Our price	P.P.
D500 ¼" Drill	7.10.0	5. 0.0	4/6
D520 ¼" 2-sp Drill	10. 0.0	7. 5.0	4/6
D720 ½" 2-sp Drill	12. 0.0	8.15.0	4/6
D820 ½" 2-sp Drill	15. 0.0	10.15.0	4/6
ABSOLUTELY FREE. Accessories to the value of 22/6 with each of above Drills.			
D390 Power Sander	6.15.0	5. 5.0	4/6

STANLEY BRIDGES	List price	Our price	P.P.
XK370 ¼" 2-sp Drill	16.19.0	13.19.6	4/6
XK380 ¼" 4-sp Drill	17.19.0	14.19.6	4/6
WOLF 74 ½" Drill	15.15.0	13.10.0	6/-
ARCOY Dovetailer	8.15.0	7.15.0	9/-
ARCOY 2054 Dr Stand	12.15.0	11. 0.0	10/-
ARCOY 530 ½" Drill	15.15.0	12.19.6	6/-

MAIL ORDER ONLY. Send cash with order to: NORTH LONDON MAIL SUPPLIES (Dept. ME), 168 Finchley Road, LONDON N.W.3.

" Hogarth " high precision lathe 7" × 42", suit College. " Schlerescope " hardness tester in case, 9 v., 100 amp. output transformer. New Super Cushman 4" s.c. chuck geared " Skinner " tailstock chuck. 4" dia. Morris wire brushes, 1/3 h.p., 110 v. d.c. motors, as new. 110 v. d.c. open type dynamo suit large traction engine, stage lighting dimmers, new. ⅜" and ½" copper tube. New 3 h.p. Villiers stationary o.h.v. engine. JAP 2A engine.—Box No. 2543 (Yorkshire), MODEL ENGINEER Offices, Hemel Hempstead, Herts. LM

OXFORD ARC WELDERS

Give you high quality and reliable welding. Oil cooled. From 70 amps. (£29), 110 amps (£41 10s.), and larger. Models available with brazing attachment. Free leaflet & lists from:

C.G. & W. YOUNG (OXFORD WELDERS)
Colne Road, Twickenham, Middx.
Tel.: 01-894 5168 & 01-894 7767.

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—101 Tottenham Court Road, London W.1. WT

BREAKTHROUGH!
New Patented All Mains Electric MINI WELDER
35 and 65 amps. output—
Ideal for Welding THIN Sheet or THICK Angle.
£19.19.0 (plus 10/- part carr.). *Complete* with all accessories.
ONLY FROM:
KELLERS WELDING CENTRE
33 Cattle Market Street, Norwich
'Phone: 24681

Collector Pays surprisingly high prices for unusual cast-iron and tin toy children's money-boxes made before 1950, especially those with working parts and moving figures.—HALEY, 5 Flushouse, Holmbridge, Nr. Holmfirth, Yorks. L-W

Bench Lathe Wanted ML7 preferred, cash waiting for good condition machine.—31 Ball Road, Llanrumney, Cardiff. MN

Perfecto 7" power shaper, unused. £40 or offers.—P. ROMNEY, 103 Bewdley Hill, Kidderminster, Worcs. M

Stationary Open Crank I.C. engines, running. Grayson 3½" B.G.S.C. lathe, faceplate, change-wheels, good condition. Would exchange incomplete model.—Fulbeck 625. M

Near Complete. Heavy duty 4½" lathe engineer-built, all machining done, geared headstock, Timkin bearings, will exchange part-finished locomotive, traction engine, or W.H.Y. Further details write—BOOTH, 43 Firbeck Avenue, Mansfield, Notts. M

INTERESTED IN SOMETHING BIG ???
Castings and Drawings for Authentic Traction Engine and Roller Models of impressive performance.
4½" SCALE LIGHT AGRICULTURAL TRACTOR, 5' 6" long and approx. 1,000 lb. weight. **4½" SCALE Wallis & Steevens "SIMPLICITY"** Roller 4' 4½" long. **3" SCALE BURRELL T.E. "BILL." 2" SCALE Fowler Showman's T.E. "PRINCESS." 3" SCALE Wallis & Steevens "SIMPLICITY"** Roller.
MACHINING SERVICE AVAILABLE FOR CYLINDERS, GEARS, CRANKSHAFTS, FLYWHEELS, ETC.
Clean steel spoke pressings for all our engines are available.
Please send 2/6 for lists.
LION ENGINEERING CO.
Limes Estate, Hardwick, Cambridge
Telephone: **MADINGLEY 485.**

Wanted. Small lathe 1½" to 3" and accessories, bits, mills, hand tools.—COOPER, 77 Lache Lane, Chester. M

Wanted. Vertical slide, angle plate, V-blocks, 6" faceplate.—SQUIRE, Whitegate, Seahill Road, Saughall, Chester. M

Wanted. A lathe and drilling machine, suitable for model engineering. Also hand tools. Will collect.—A. PHILLIPS, 18 Sunnymead Avenue, Gillingham, Kent. Medway 52165. M

500 Various HSS number drills, 1s. 3d. each, £20 the lot.—181 Nightingale Road, London N.9. M

3½" M Type Drummond on stand, countershaft, motor, 4-jaw, 3-jaw drill chuck. £60.—9 Minerva Drive, Watford, Herts. M

Sheet. For your ferrous and non-ferrous sheet and plate requirements, send s.a.e. for list. Bending service by quotation.—ROBERT HILL, Dept. M.E., 3 Ash Street, Woodley, Stockport, Cheshire. M

IN THE UNITED STATES
We have nearly everything. Nearly everything advertised in Model Engineer is available from our stock. Give us a try. Our catalogue completely describes a full range of model engineering supplies from books, to models, to tools. It only costs $2.
CALDWELL INDUSTRIES
Box 170/A-Luling, Texas 78648

Copper Tube, sheet, bar, boiler material. S.A.E. details—R. FARDELL, Farnley Tyas, Huddersfield, HD4 6UL. MO

For Sale. Hand shaper. Offers—Ring 01-902 0147/8 (Wembley). MN

MODELS & MATERIALS

We will pay Actual CASH for good models of Locomotives, Traction and Showman's Engines, Stationary Engines, Marine Engines, Boilers, etc.
DISTANCE NO OBJECT
CHERRY'S LTD.
62 SHEEN ROAD
RICHMOND, SURREY
Tel: 01-940 2454

If you have a model to sell, consult STEAM AGE. Though specialising in Locomotives and Traction Engines we are interested in buying models of all descriptions.
STEAM AGE 59 CADOGAN STREET LONDON, S.W.3.

For Sale. 3" scale Burrell s.c. traction engine, 5" gauge "Maid of Kent." S.A.E. details.—Box No. 2539 (London), MODEL ENGINEER Offices, Hemel Hempstead, Herts. LM

MAIL ORDER—Ferrous and non-Ferrous Sheet, Tube, Bar, Section and Wire.
No order too small or troublesome.
Overseas enquiries welcomed.
S.A.E. for quotations and lists.
"METAL FOR MODELLERS"
174 PRINCE OF WALES LANE, BIRMINGHAM 14. 021-474 3971

Exchange. Rare model open type dynamo; antiques and cash for beam engine, or oil or electric locomotive.—Box No. 2542 (Glamorgan), MODEL ENGINEER Offices, Hemel Hempstead, Herts. LMN

Wanted. Gauge 1 steam locomotive, one requiring attention may suit.—CLEMENS, 133 High Street, Pershore, Worcestershire. LMN

Wanted. Electric time transmitter, as designed by Charles Blazdell in M.E. for April, 1968, with or without case. Also M.E.'s for 1968-1970 wanted in clean condition.—11 Frimley Green Road, Frimley, Camberley, Surrey. M

SEVERN-LAMB LTD.
Make (Amongst other things)
- **Museum Models**
- **Glass Case Models**
- **Animations**
- **Locos—O to 15" gauge**
- **Boilers**
- **Replica Great Western Nameplates**

WESTERN ROAD
STRATFORD-ON-AVON (3878)

CANADA. U.S.A.
Materials, etc., for the Model Engineer
Custom built Locomotives.
Castings for L.B.S.C.
Locomotives to order.
Stuart Turner
A. J. Reeves & Co. Castings.
MYFORD 7 and SUPER 7
Lathes and Attachments.
PERRIS
TOM SENIOR
Catalogue New $1.00.
PEN MODELS
THE "STEAM SHOP"
259 Carolyn Drive,
Oakville, Ont. — 844-6418
(Open Evenings and Weekends
Visitors Welcome)

Collector Wants 3½" gauge locomotives, cast-iron toys, electric or steam trains.—HAMILTON STERN, 33 N. La Salle Street, Chicago, Illinois, 60602, U.S.A. LMN

Traction Engine, M/E Minnie, part-built, for sale, first-class workmanship, £35 o.n.o.—Phone- Maldon 3344 or 94 Crescent Road, Maldon, Essex. M

Drawings and castings for 18 close scale steam locomotives in 3½" and 5" gauges.
3½" Gauge L.N.E.R. B/1, B/2, A/3, A/4, L1/T, V/2 "Highland Loch," Stirling 8' Single, L.M.S. Princess and Duchess, Southern Schools, G.W. King.
5" Gauge L.N.E.R. A/3, D/49, Austerity 2-10-0, Large and Small Boilered G.N. Atlantics, Stirling 8' Single, "Nigel Gresley," by Martin Evans.
Stationary Engines. 1" x 1½" Horizontal, 1" x 1½" Vertical, ¾" and 1" x 1½" Horizontal Compound, 2" x 2" Reversing Vertical, 2" x 2" Reversing Horizontal, 1" Scale Sanderson Beam Engine, *circa* 1846.
Available shortly. 1" Scale Murdock Aitken **Table Engine,** *circa* 1840.
Locomotives. 3½" gauge S.R. King Arthur, G.C. Atlantic L.N.E.R. P/1 2-8-2.
H. CLARKSON & SON
53/57 LAYERTHORPE, YORK
Tel: 54873

Build a One-eighth Scale Model of a 32-pounder ships gun of the Nelson era. Kit includes all metal parts—cast iron barrel (approx. 15½" long, weight 15 lb., bored 3" deep only), trunnion bands, tie rods, etc., working drawings, sufficient oak to complete the model, turned oak wheels and axles. Model can be completed with woodworking tools. Complete kit, 126s. Also available as a kit of metal parts only at 93s. or barrel only at 69s. Postage and packing 12s. (U.K. only). S.A.E. for details.—H. L. PEARSON, 5 Ruskin Avenue, The Straits, Sedgley, Dudley, Worcs. MN

STEEL TUBES
Assorted off-cuts approx. 1" x 16G. to 3" x ½".
One to three feet long.
28 lbs., **£3**; 56 lbs., **£5**; 1 cwt. **£7.**
Delivered free your address (U.K.)
C.W.O.
BRITISH & GENERAL TUBE CO. LTD.
Trading Estate, SLOUGH

For Sale. Stuart engines No. 4 slip eccentric, Double 10 with feed pump, 10 vertical, Sirius, Sim with pump. Other engines, boiler, etc., particulars from—H. A. WEBSTER, 2130 Kings Road, Victoria, British Columbia. M

"Tich" Wanted. Would buy unfinished model if first class work, write—HALL, Main Street, Ravenstone, Coalville, Leicester. KLM

Wanted. 3½" gauge locomotive in running order, or nearing completion, any type considered, I am also interested in 1½" scale traction engine complete or in final stages.—Box No. 2533 (Derby), MODEL ENGINEER Offices, Hemel Hempstead, Herts. KLM

Nameplates, smokebox number plates, makers' plates, whistles, etc., wanted.—227 Kingsway, Manchester 19. 061-224 4602. KLM

Pressure Gauges ¾" and 1" diameters. S.A.E. for descriptive list.—F. DENNIS, 3 Ward Avenue, Cowes, Isle of Wight. T/C

Collector Wants old model steam engines good prices paid. Write to—AKINS, 37 Radnor Drive, Shepshed, Loughborough, Leicester. EQ

10¼" Gauge Locomotive Wanted. Details and price to—227 Kingsway, Manchester 19. 061-224 4602. KLM

Wanted. Blue prints for 4-8-0 2½" locomotive Euston JAJ series 1932.—Dowson, 39 Victoria Street, Scarborough. H-M

Wanted. Model steam locomotives and traction engines. Any gauge, age or condition. Will view anywhere.—SNODIN, 43 Market Place, Cromford, Matlock, Derbyshire. Tel.: Wirksworth 2659. J-O

"Tich" Chassis 3½" gauge 60 per cent. finished all materials, callers preferred. Wanted. Traction engine or other interesting steam models; partly finished or requiring repairs.—10 Whitbarrow Road, Lymm 2320. KLM

For Sale. Gas engine, about one-horsepower, also petrol engine about same power, £25 each. Stuart Sandhurst, £60, perfect.—BLACKSHAW, 7 Roe Street, Macclesfield, Cheshire. LMN

Wanted By Elderly Enthusiast, old Lowke, Bing, Marklin, steam locomotives even those requiring attention or in bits, 1 to 2 gauge. Also tin coaches and engines of the same make, clockwork or electric.—Box No. 2550 (Surrey), MODEL ENGINEER Offices, Hemel Hempstead, Herts. M

5" Gauge 0-6-0 tender locomotive, running order, needs painting; offered in exchange for powerful 3½"/5" G. tank locomotive, any type, part finished considered.—41 Woodlands Avenue, Stone, Staffs. ST15 0JT. Tel: 3714. LM

Wanted. Unfinished 3½" or 5" locomotives, with drawings, materials, and castings to complete. W.H.Y. "Model Engineer's." All answered. Will collect.—Box No. 2535 (Lancs.), MODEL ENGINEER Offices, Hemel Hempstead, Herts. MNO

Wanted. Electric blower for steam raising 7¼" gauge Pacific locomotive. Chimney internal diameter 2⅜". Good price paid for efficient machine.—WOOD, Cliff Cottage, Aust, Gloucestershire or ring—Pilning 729 evenings, reversing charge. M

Wanted. Part complete 1¾" Allchin engine, finished parts, or complete engine.—SINCLAIR, 8 Avondale Court, Gosforth, Newcastle Upon Tyne. M

For Sale. 5" "Minx" and tender, soundly built. Excellent steamer and hauler. Copper boiler, £675.—HELLER, Twyford 3037 (Hants.). M

For Sale. 3" Burrell single T.E., built and finished to high standard. Copper boiler, good steamer, little used, £1,300.—HELLER, Twyford 3037 (Hants.). M

5" Gauge Sentinel locomotive. Well detailed with a good performance. S.A.E. for details, £230.—Box No. 2547 (Bristol), MODEL ENGINEER Offices, Hemel Hempstead, Herts. M

5" Gauge 0-6-0 "Butch" tank locomotive new £325. 200' 5" gauge track on trestles, £25. Two 5" gauge passenger cars, £25. 3½" gauge G.W.R. County Class, painted and lined £325.—7 Thornborough Close, Little Bowden, Market Harborough. Phone: 5289. MNO

For Sale. Boiler and many parts for 3" Lion traction engine.—52 Burntwood Lane, London S.W.17. WIM 1460. MNO

BOOKS, PUBLICATIONS ETC.

"Model Engineers" volumes and individual issues always available and purchased.—TRACTION ENGINE ENTERPRISES, 4 Station Road, London E.4. T/C

Required "M.E." No. 1421, also for sale over 1,000 back numbers of "M.E.'s," and 250 "English Mechanics." S.A.E. for details.—Box No. 2546 (Hants.) MODEL ENGINEER Offices, Hemel Hempstead, Herts. M

Drawings for Sale. 3½" gauge 2-6-2 "Bantam Cock" tender engine. Eight sheets complete, 30s. post paid.—COWLEY, 8 Brackyn Road, Cambridge. M

Wanted. "Model Engineer," volume 135, Nos. 62 and 66 or photostat copies of part 3 and part 7 of "New M.E. Traction Engine."—HAYHOE, "Priory House," West Kirby, Cheshire. M

"M.E." unbound volumes, 64, 65, 68-70, 75, 77-79, 92, 94, 103, 106-133, £20. Also volumes 108-133, £15. Buyers collect.—Tel: Weybridge 45839. M

American RR Boox. Steam, models, diesel traction and magazine subscriptions, etc. Send S.A.E. for list to—Box 9 LEONARD CLYDE, The Mount, Ewell, Surrey. ALT/WS

£80 (minimum) Offered for "M.E." 1-80. (Portions welcomed/available.)—LAMBERT, 60 Salhouse Road, Rackheath, Norwich. H-O

Model Engineer requires the following bound volumes of "M.E." in good condition: 108, 112-119 inclusive, 128-132 inclusive. Also complete sets of loose issues, volumes 128-132 inclusive. Offers please to the—EDITOR, MODEL ENGINEER, 13-35 Bridge Street, Hemel Hempstead, Herts. T/C

Wanted. Bound or unbound complete volumes "Model Engineer," Nos. 1 thru 133, all or part. Will be in G.B. September 12th-October 7th. Please write—BRAUN, c/o Collet, 6 Chapel Road, Epping, Essex until October 5th, 1970. Thereafter BRAUN, 709 B Bowen, China Lake, California, 93555, U.S.A. MNO

"Model Engineers," 38 unbound volumes, £15. 97-134, 33 complete, 26 copies missing before volume 108, others available 84-128, some complete.—97 Newcourt Road, Topsham, Exeter. Phone: Topsham 4606 evenings 6-7. M

BUSINESS SERVICES

Interchangeable Watch Material at rock-bottom prices, return post. Price list 9d. (U.K. Postal service only)—J. H. YOUNG & SON, 133 London Road, Chippenham, Wilts.

CARS, ROAD VEHICLES, ETC.

National Vintage Farm Tractor Club Rally, September 13th, 12.30 p.m.—Norton Juxta, Twycross, Leicester, A444 Road. M

ELECTRICAL

New. 1 h.p. single-phase 230-250 volts, standard cap. start, 1,440 r.p.m. motors, £16.10.0 carr. paid stock. Also ½, 1½ and 2 h.p. ditto.—AIREDALE LTD., 11 Start Street, Bradford 5. T/C

Second-hand Synchronous Motors ex electric slotmeters 200/250 volts a.c., 50 c. with geared mechanism, easily converted to own particular use, various types large stock. From 4s. each.—TRADEX METER CO LTD., 67 Maple Road, Surbiton, Surrey. Tel: 01-399 2234/5 6. T/C

A.C. Motors, Self-start, induction 220/250 v., 50 cycles, 1-phase, 1,425 r.p.m., ¼ h.p., 87s. 6d.; 1/3 h.p., 105s.; ½ h.p., £6 16s. Perfect and guaranteed, carriage England, 7s. 6d.—JOHNSON ENGINEERING COMPANY, 319 Kennington Road, S.E.1. RELiance 1413. T/C

PHOTOGRAPHY

Projectors. Home assembly kit 2" x 2", 2½" sq., 3½" s. Stereo 300 w./500 w. Lo 10" x 10" viewer, 300 w.; also 15" Episcope, £10 17s. 6d. Fan base kit, £4 17s. 6d. Opticals and screens. Micro film readers. S.A.E. brochure.—E. MARSHALL-SMYTH LTD., 64 Norwich Avenue, Bournemouth. T/C

GENERAL

For Reliable Introductions to friends or future marriage partners write to—PRIEMA SERVICES, 1 Park Road, Hampton Hill, Middlesex. Tel: 01-979 7491. T/C

Lone Model Engineer seeks companionship of interests. Late forties. Dagenham or district.—Box No. 2548 (Essex), MODEL ENGINEER Offices, Hemel Hempstead, Herts. M

Wanted. Storage accommodation for several dozen books on general knowledge for a long period.—Box No. 2549 (Kent), MODEL ENGINEER Offices, Hemel Hempstead, Herts. M

Penfriends Home and Abroad. S.A.E. for details.—EUROPEAN FRIENDSHIP SOCIETY, Burnley, Lancs. T/C

Original Paintings of your favourite locomotives, traction engines, etc., from £10 each, for details write—HATFIELD, "Dun Romin," 36 Cadeby Road, Sprotborough, Doncaster, Yorkshire. S.A.E. M

Printed in Great Britain by ELECTRICAL PRESS LTD., Maidenhead, Berks., for the Proprietors, MODEL & ALLIED PUBLICATIONS LTD., 13/35 Bridge Street, Hemel Hempstead, Herts. Published by the ARGUS PRESS LTD., 12/18 Paul Street, London, E.C.2, to whom all trade enquiries should be addressed.
Registered for transmission by Magazine Post to Canada.

M.E. QUERY COUPON SEPTEMBER 1970

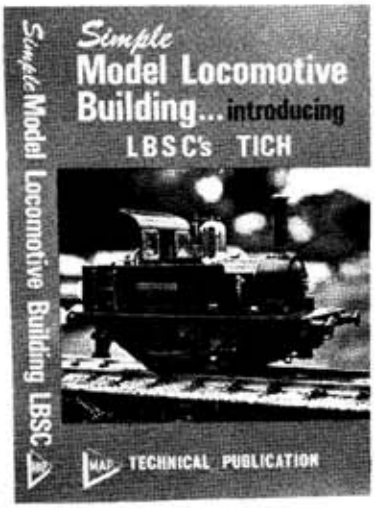
MAP The Finest Range of Model Technical Books in the World!

200 LBSC'S TICH

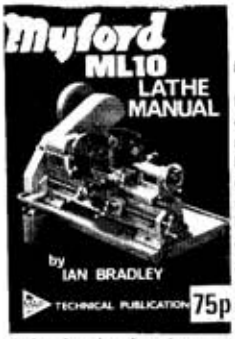
One of LBSC's best-known 3½ in. gauge locomotives, "Tich" is the subject of the "words and music" which serve as an introduction (as they have done so often before!) to the ordinary man's best home-built model locomotive. A small lathe, little or no prior knowledge, a minimum of skill and strict adherence to the simple instructions can lead to years of pleasurable hobby hours.

Seventeen fact-packed chapters cover every aspect of construction, up to steaming and driving. Profusely illustrated with diagrams and photo-plates.

9¼ x 6 in. 268 pages plus 29 pages of plates. Hard bound, gold-blocked on spine, full-colour dust cover. **42/-**



146 MYFORD ML 10 LATHE MANUAL



By Ian Bradley

For all ML 10 lathe owners and operators, and indeed for all small lathe users, this is an essential tool! Setting up and care of the lathe, how its various components work together with descriptions of suitable accessories and their use, the operation of the lathe in the functions normally expected of it, plus additional useful work that can be done with its aid.

Size 8½ x 5½ in. 112 pages plus 12 pages of half-tone plates. 72 line drawings in the text. Two-colour dust cover. Bound linson. ($3.00) **15/-**

105 METAL TURNING LATHES

8½ x 5½ in. 154 pages. 160 line drawings and photo-illustrations. 9 appendices. Bound in hard covers with linson cloth, gold blocked title on spine.

25/-

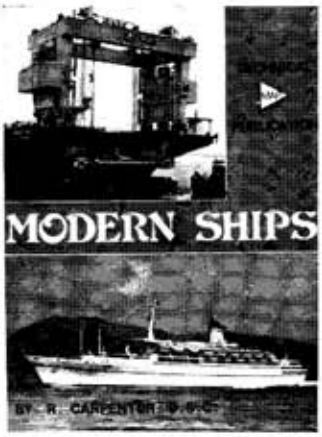
A comprehensive range of sizes of lathes is covered, and embraces all those used in general engineering from the smallest to about 6 in. centre height, but excluding watchmakers' lathes at the one extreme and heavy industrial lathes at the other. Installation and driving equipment, accessory equipment and tools and tool holders. Operations that may be performed upon a modern lathe.

147 MODERN SHIPS

R. Carpenter, D.S.C.

A broad cross section of the world's shipping during the past 15 years. Could be called 'Modern Ships, their Voyages and Cargoes, together with the Ports they visit and the Passengers they carry . . .' Chapters on Oil Tankers, Bulk Carriers, Container Ships, Vehicle Ferries, Passenger Liners, Cargo Liners, Crew Accommodation, Coastal Ships, Tugs, Cargo Handling, Trawlers, 12 Passenger Cargo Liners, and Miscellaneous ships together with appendices on organisations and bodies closely connected with ships. Many profile drawings, wash drawings by the author, very many photographs, line drawings, tables. Written with expert understanding in a style for the enthusiast layman to appreciate.

9¼ x 7½ in. Bound in balacron on high quality gloss paper. 220 pages. Two-colour photo dust cover. **£5**



53 RING CIRCUITS IN THE HOME

The wider use of electrical appliances demands that the home handyman extends the existing wiring of his home or workshop in a safe and simple way. Ring Circuits in the Home provides the answer to all the questions likely to arise in planning, fitting, testing and checking the new installation.

7¼ x 4¾ in. 94 pages. 54 illustrations. **7/6**

149 AERO-MODELLER ANNUAL 1970-71

128 pages size 8½ x 5½ in. Coloured dust jacket bound hard boards with full colour cover illustration. Publication date August 28th

Price **12/-**

More milestones in the progress of Aeromodelling captured permanently for the ardent reader. Lead features on Electric power, Airfoil research and the Wankel motor. For the first time, full revelation, with designs, diagrams & pics of electric Round the Pole models capable of aerobatics and fast flight on over 40 ft. lines! Analysis of airfoils for gliders by that globe-trotting most experienced Internationalist of all time Peter Allnutt with K. Kaczanowski, and full constructional data for the Polish 10 cc. S.W. 992 'Wankel' type engine will be references for years to come. Add over 40 of the top designs of the year—contest winners, unorthodox, new structures, free flight, control-line and radio controlled plus the humble chuck gliders. Sprinkle with features on Centre of Pressure, Model demonstrations, How to get the best realism in finishes, and the latest Annual is seen to be right up to expectations. A pot-pourri of the very best, produced to satisfy all tastes, and, as ever, the best value in reference books that money can buy!

HOW TO ORDER. Ring round the reference number of the titles you have chosen. Carry out totals to cash column and then total up at the bottom.

MAP

53 · 200 · 146
149 · 105 · 147

Name .....

Address .....

.....

.....

Please add 1/- packing & postage for orders of 12/6 and below. Above this orders are POST FREE.

Model & Allied Publications Ltd.

13-35 BRIDGE STREET, HEMEL HEMPSTEAD