Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

This issue includes :

- POWER AT PENSHURST
- CANTERBURY NZ SHOW
- END OF A MOORLAND RAILWAY

ONE SHILLING 22 SEPTEMBER 1960 VOL 123 NO 3089

Model Engineer

Incorporating Mechanics (Home Mechanics and English Mechanics) and Ships and Ship Models

IN THIS ISSUE

NEXT WEEK

Mr Henry Watkins, of Somerset, contributes the first article in a short series describing the construction of a jig-saw machine suitable for the home workshop.

ONE SHILLING · 22 SEPT. 1960
VOL 123 · NO 3089

Published every Thursday Subscription 65s. (USA and Canada $9.25), post free

The Editor is pleased to consider contributions for publication in MODEL ENGINEER. Manuscripts should be accompanied by photographs and/or drawings and should have a stamped addressed envelope for their return if unsuitable.

19/20 Noel Street, London W1.
GERrard 8811

A WEEKLY COMMENTARY

Smoke Rings

By VULCAN

IS there any explanation why some subjects are ever popular with model engineers, while others are neglected through the years?

I was discussing this topic with Martin Evans the other day but neither of us could discover the fundamental reason.

There is no doubt that the locomotive is unique as a modelling subject. It offers wonderful workshop experience, it can be a useful piece of mechanism when completed and it is a joy both to control and observe.

What of others?

But what of other subjects? Trams have a reasonable following, as was demonstrated recently when the Tramway and Light Railway Society held an exhibition in London. Possibly the tram's picturesque qualities explain its popularity. But why are buses so neglected? And lorries, steam wagons, vintage cars, mobile cranes, fire tenders and a host of other fascinating vehicles?

There is the argument, of course, that the working model appeals more than the static, but this is not the complete answer for there are a great many "working" models built for exhibition purposes which never turn a wheel after they are finished. Many excellent model ships are condemned to life in a glass case instead of their natural element.

One feasible explanation seems to be that technical information and drawings of the full size subject are more freely available with some things than with others. But this again is not a complete answer.

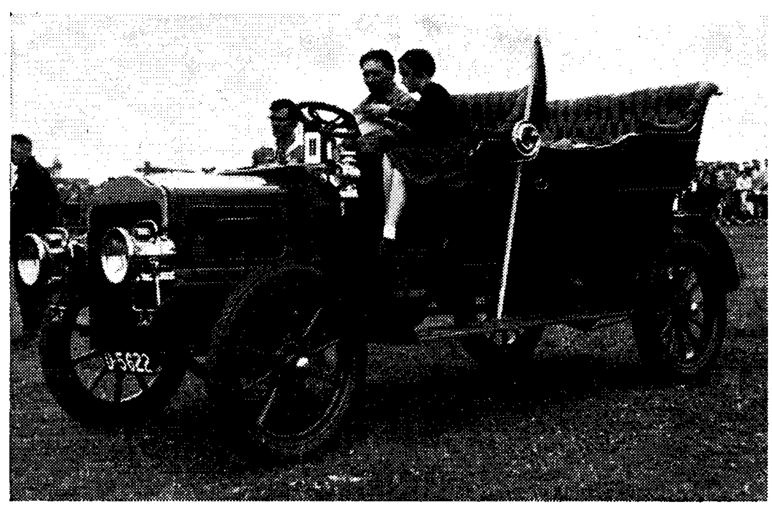
That many neglected subjects do not require the use of a proper workshop or lathe is no explanation for a great many excellent ship models are turned out on the proverbial kitchen table.

I confess I am baffled. Does anyone know the answer?

The Exhibition

AS already announced in these columns, it has not been found possible to organise the Model Engineer National Models Exhibition for next Christmas. Revised plans will be published as soon as possible, but I am taking this opportunity to remind readers that it will not be held in a few months' time.

The shortage of exhibition halls has long been acute in London and



Steam locomotives are popular subjects for modelling. But why are steam cars, like this 1906 White rescued from a scrap heap by Saxon Littler, so neglected?

this results in great pressure on the venues which are available. Most of the suitable dates are booked ahead for years and this makes the task doubly difficult.

However it is something we are determined to overcome and I hope to have firm news of our plans within a few weeks.

It seems likely that we shall revert to a date in August but more of that later.

Committee's findings

Incidentally, the shortage of exhibition space has been worrying everybody concerned with the problem of publicising British products and an official committee was set up to look into the matter.

They found that there was a genuine demand for more facilities but they must be in a central part of London. To build vast new premises, with car parks and ancillary buildings, would involve such a huge sum that it was felt it would only be carried out by the Government. But nothing has happened to give any hope that the Government feel it necessary to intervene.

I spent a pleasant day with Mr S. L. Sheppard at Alexandra Park, looking at the possibility of using the North London premises for our exhibition. Shep's eyes glinted at the vast spaces available and he was lyrical at the ample car parks which could have accommodated everybody's vehicle.

But—and it is a big but—it is an inaccessible spot and in the end the old Ally Pally was discarded as only a "possible."

Enquire within

I MUST admit that I waited for the publication of the *Model Engineer Handbook* (price 3s. 6d. and published by Percival Marshall) with some trepidation.

It has, of course, been out for three months but now I can say what worried me. It was not what was in the book but what, of necessity, had to be omitted.

I was very happy about the considerable number of tables and data. Such a collection of useful facts and figures have not been published in a handy form before and I was sure that they would fulfil a useful purpose.

The book does contain a list of model engineering clubs, with a summary of the facilities available and the names and addresses of the secretaries. Such a list is a formidable undertaking and it seemed likely that errors could arise due to changes of officers after going to press.

I am glad to say that very few have so far been notified to the editor of the book, although an invitation is included in each copy to readers to send corrections or suggestions for future editions.

One sad omission was that of the Brighouse Society. How they came to be left out I do not know but obviously that is something which will be put right as soon as possible.

Source of information

A friend telephoned me a week or so ago and wanted the names and addresses of the secretaries of three clubs in the vicinity of his home. I went to my copy of the book and was able to give him the information he wanted immediately. I could not resist the dig that he should invest 3s. 6d. in a copy of the *Model Engineer Handbook*.

Perhaps I could finish this note with a renewal of the invitation to readers to comment on the contents of the book. Let me know if there are features you would like to see in the next edition. I will guarantee that all ideas will be given most careful consideration.

David's day

WHEN George Smith, secretary of the Malden Society of Model Engineers, read in the *Sunday Express* of the ambition of a crippled boy to become an engine driver he put forward a scheme to his fellow members.

Why not ask the editor of the *Sunday Express* for the address of the boy, 11-year-old David Matthews, and invite him to drive an engine on the society's track?

Club members readily agreed and offered their services. The editor of the *Sunday Express* not only let them have David's address but sent a reporter and photographer to cover the story. The outcome was a half-page feature in the *Daily Express* of Monday September 12.

Apart from four of five club engines operating on the society's track there were two 7¼ in. locomotives put at David's disposal. One was Mr T. P. Snoxell's Atlantic, the other was Mr Smith's Southern Mogul, a picture of which appeared in the *Express* with the young lad at the regulator.

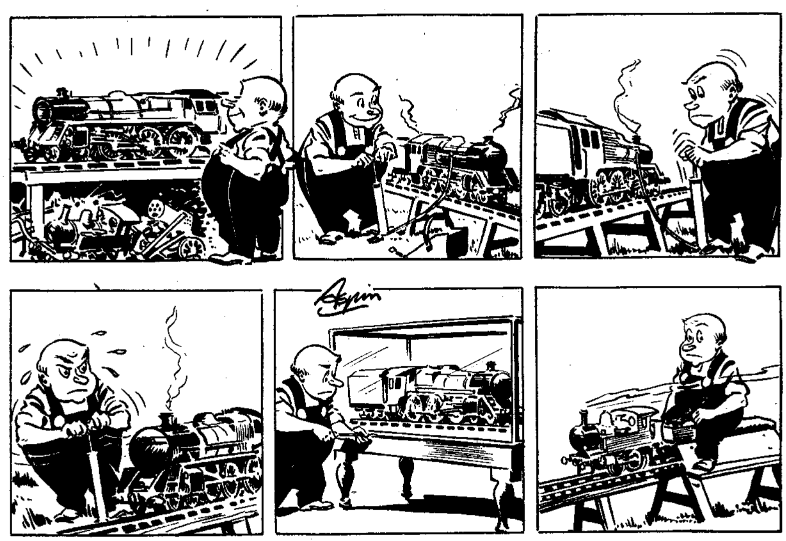
David, who spends many hours playing on the floor with his toy trains, declared the trip to be better than he expected. Said his mother: "I can't remember when David wasn't mad on trains. He'll remember today for the rest of his life."

Four years ago David fell ill with a wasting disease, muscular atrophy, but it has not dulled his ambition to be an engine driver. He is firmly convinced that one day he will walk again.

Cover picture

Brian Western, our staff photographer, snapped up this picture of a C class 0-6-0 tender engine, working happily in Dover harbour, during a recent assignment in the cinque port.

CHUCK . . . . . . THE MUDDLE ENGINEER



Continued from 8 September pages 287, 288 and 289

Finishing the faceplate

MARTIN CLEEVE *concludes his notes on a T-slotted accessory for the EW lathe*

AFTER the milling operations have been completed, the unwanted corners must be removed from the slot sectors to facilitate the final machining of the periphery of the plate after assembly.

The initial marking out for this rough sawing operation was carried out by referring the components to the plain 5 in. dia. plate, the periphery being used as a datum for scribing an arc on the underside of each sector.

A $\frac{5}{16}$ in. spigot was lightly force-fitted to the reamed hole at the centre of the disc. The two plates or sectors *A* and *B* were positioned against the spigot and, after the necessary adjustments for symmetry, were clamped to the disc, *A* and *B* being easily scribed while they were fixed. By the use of $\frac{5}{16}$ in. spacing blocks, the remaining four sectors were scribed when positioned in a manner similar to that shown in Fig. 6.

Fig. 7, illustrates the arrangement adopted to slit the sectors roughly to shape. The saw is a 4 in. × $\frac{1}{16}$ in. Firth Speedicut. Once again use was made of an adjustable height toolpost to hold the components, although here an ability to adjust the height was of less importance than the ease of swivelling about the central stem so that the saw should cut approximately to the scribed line by two or three adjustments. A hexagon socket-head grub screw was substituted for gripping the component at the left hand side because a cap screw at that point would not clear the head of a bolt on the saw arbor.

As an intermediate stage helpful to final assembly, sectors *A* and *B* were each fixed by two screws at the inner end only, and *C, D, E, F* by one screw each.

Owing to the removal of the corners from *C, D, E, F*, only two useful datum lines remained. Fig. 8, shows how these were used as an initial marking out reference. The sectors were marked on top (with the milled lips underneath) were drilled tapping size, and were used for transferring the hole position to the disc.

After lining up *A, B* as in Fig. 6, clamp, drill the disc, enlarge the drilled holes to clearing size, countersink or counterbore, thread *A, B* and fix with four screws, re-checking for alignment before the final tightening.

Fig. 6 also shows how to position the corner sectors before clamping and drilling. The operation is illustrated in Fig. 9.

When all six sectors have been temporarily fixed in this way, a circle scribed at a radius of 2¼ in. will intersect all eight *X Y* lines and the centre lines on *A B*, thus positioning the remaining ten fixing holes. Before the final assembly, the central hole in the 5 in. disc was enlarged to about ½ in. The very attractive task of taking a final cut over the periphery and face, to clean up the rough sawn edges of the sectors and to get rid of the projecting screw threads, was carried out in the ML7 lathe, but with the faceplate mounted on its own lathe spindle to which bushing steady support was given.

No doubt the reader will have noticed that screws *C, D, E, F* (Fig. 8) are not giving such close support as may appear possible or desirable for the inner corners of these sectors. The reason for this will be seen from the illustration of the rear of the finished plate (Fig. 10) which shows the proximity of two of these screws to two of the flange fixing screws. These screws were positioned here

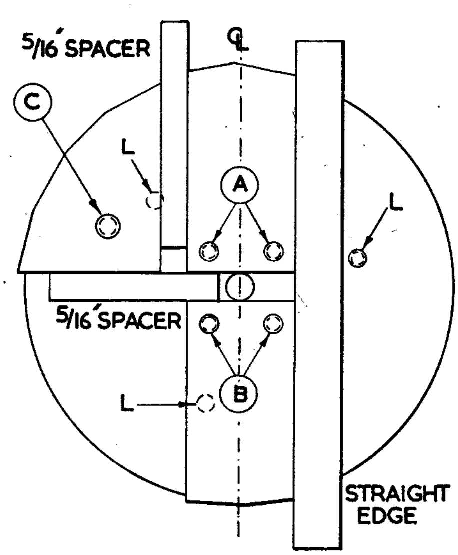
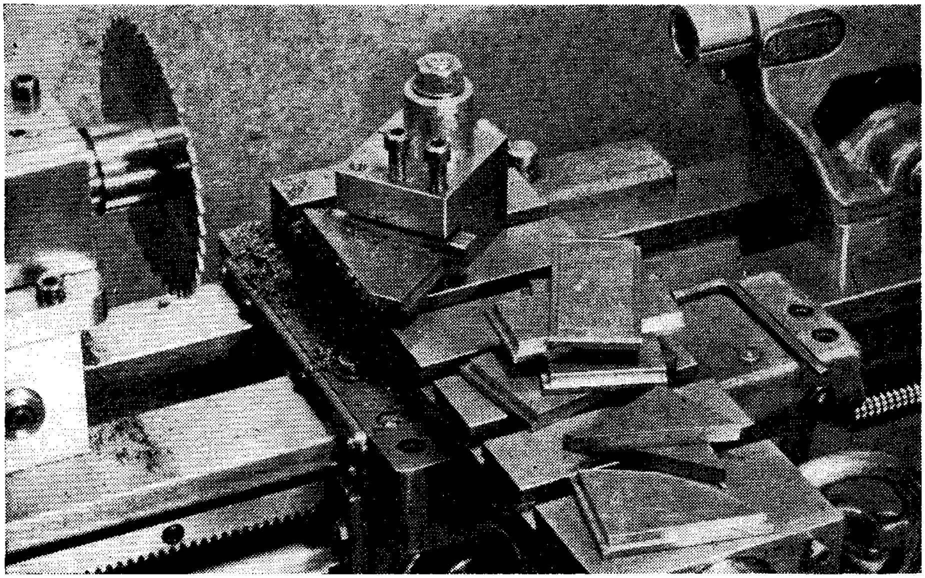
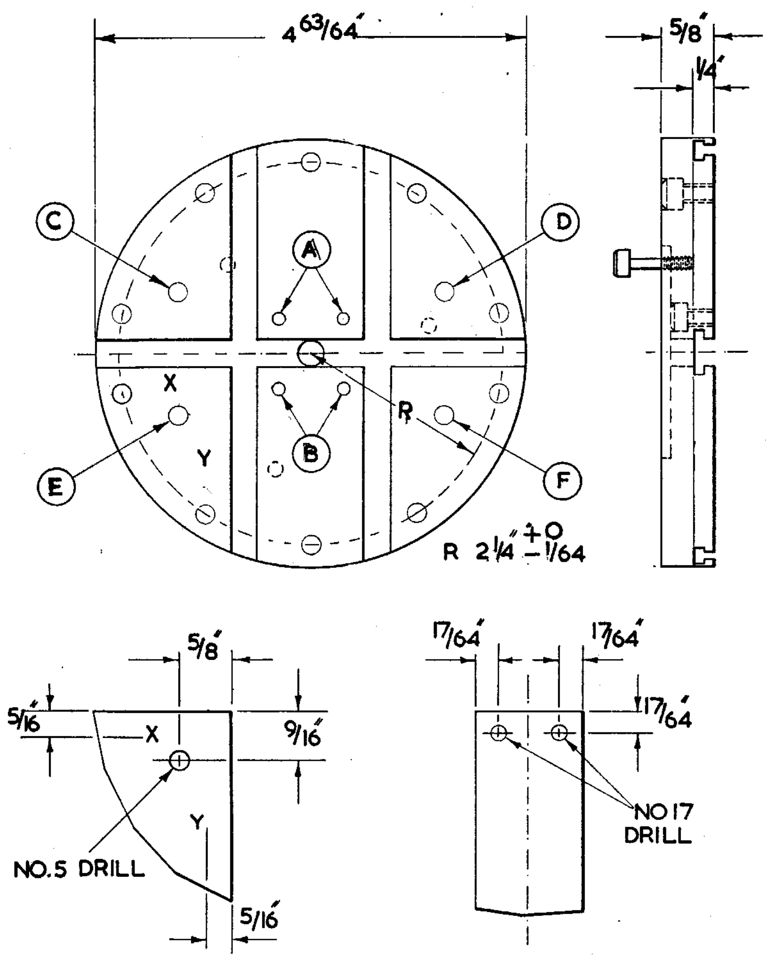


Fig. 6: After adjusting to centre line, fix A and B by the four screws (No 1 BA). Position C *by $\frac{5}{16}$ in. spacers and fix by screw* C

Fig. 7: Right, as the work is underneath, it is fed to the saw from the rear

Fig. 8, below: Assembly details and initial marking out instructions

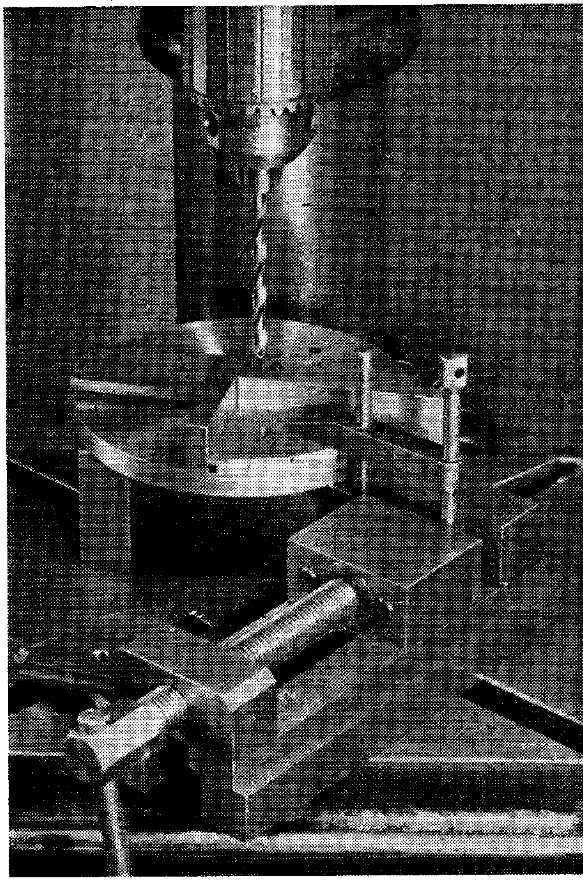


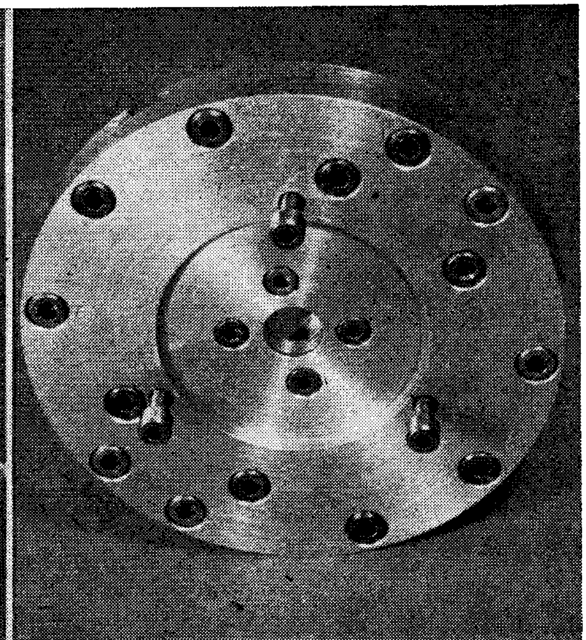


so that the slot sectors should, as far as possible, hide all three flange screw holes. Had this point been foreseen, the holes would not have been allowed to break through, and *C, D, E, F* would have been placed nearer the centre although, surprisingly the register recess prevents the ideal positioning of *C, D, E, F* with the result that a further inward movement of only about 1/4 in. would be possible. However, the effective position of these screws is not so important as it may seem at first. As I mentioned in the articles on the T-slotted cross-slide, components should not be held in such a way that the T-bolt tends to tear up the sectors. Clamping should be arranged so that the lips have only to resist dead weight and cutting forces. The ability of the plate to do this may be judged from the fact that any single T-bolt, whenever placed, will, in effect, be held by a minimum of six screws in the plate itself.

At *A, B* (Fig. 8) cap screws were used for special reasons. Here the reader is recommended to use the countersunk type of hexagon socket screw, and if it is desired to adopt the 1/4 in. BSF size throughout for sector fixing, the 17/64 in. dimension shown in Fig 8, bottom right, should be altered to, say, 5/16 in., so that the increased screw diameters will not interfere with the slot lips. Drill No 5, of course, instead of No 17.

I strongly recommend this mode of construction for making almost any kind of T-slotted table. But where, for instance, a similar circular assembly is being made for use as a horizontal





Above, left: Facing and fitting the slot sectors. Right: Rear view of the finished faceplate

rotary indexing table, it would be well to make the sector pieces from stock with a thickness of $\frac{3}{8}$ in. The sector fixing screws then need not break through the upper surface. Thinner material was chosen for this faceplate in the interest of lightness and economy. ▣

FOR YOUR BOOKSHELF

GETTING THE MOST FROM YOUR LATHE

Milling in the Lathe, *by Edgar T. Westbury* (*Percival Marshall*) 6*s*.

EVERY man who runs a small workshop, whether for pleasure or profit and whose only machine tools may be a lathe and a drill press, soon wants to make those machines do all they are capable of to quicken and better his work.

It is to such that the reprint of Mr Edgar T. Westbury's well known book *Milling in the Lathe* will come as a boon. In it the author describes in concise language the setting up and milling of some very awkward jobs in the lathe and also some simple ones on various classes of work. In most cases the text is helped by an excellent illustration of the set up.

Very wisely most of the work shown can be done with simple cutters and several of which can be made in the home workshop. If I had to teach a beginner milling in the lathe I would certainly advise him to make the cutter head shown on page 13, Fig. 7. For milling broad faces it is one of the most useful types that can be made in single tool heads.

Next I would say make the cutter spindle shown on the book cover and bottom picture at page 89. It is a most versatile tool for small work and can be used in any position so long as a belt can be got on it. For many years I have used such a block, though mine is rather more robust and has ball bearings for high speed grinding work. For drilling, port cutting, it is a must, although other and more complicated ones are shown in the book.

Mr Westbury rightly stresses the importance of keeping cutters sharp and then tells us (page 110) that sharpening can only be carried out on a special machine, etc. In view of the importance of the subject, that is a pity as there is not great difficulty in grinding ordinary straddle mills, and hollow ground circular metal saws in the lathe provided high enough speed can be given the grinding wheel to do its work properly, and the makers' cutting angles are adhered to.

For those who like to drive spindles from the old and tried overhead gear the author shows quite an elaborate arrangement which can be made from easily obtained materials. Several pages are devoted to indexing, and fixtures for it are explained and illustrated. It is very awkward to have cut, say, an 80 tooth wheel and find you have half a tooth left, due to faulty indexing. So read those pages carefully.

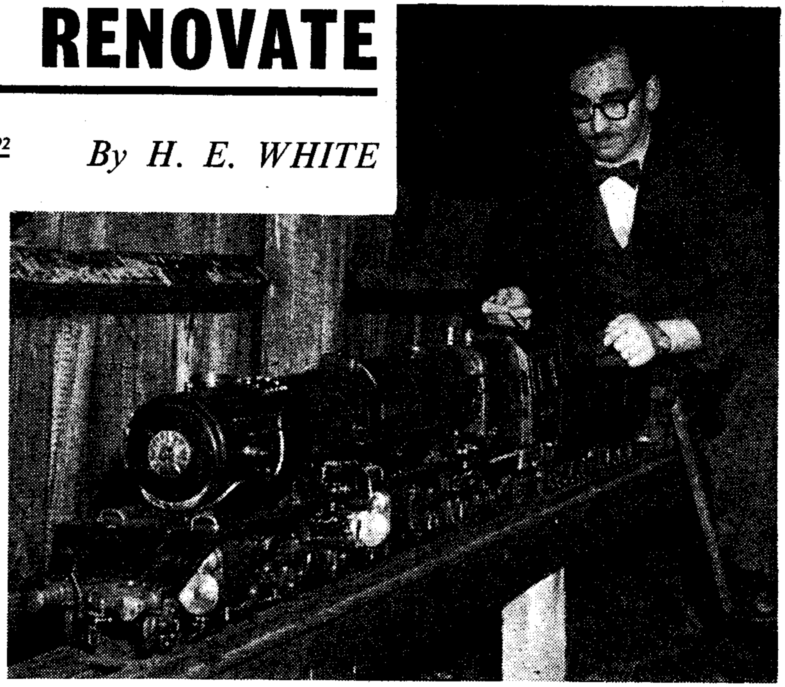
The whole book is full of most useful information of interest and value to every man who wants to get the most out of his lathe.—E.W.F.

OPERATION RENOVATE

Continued from 8 September 1960, pages 290 to 292

By H. E. WHITE

With the valve gear erected and all the parts again in place, the engine is in good trim for another year



Cleaned and overhauled, the 2-6-6-4 ARTHROPOD *awaits a new season*

By this time the valve gear has been dismantled. Pivot joints, die-blocks, pins, and so forth have been renewed and refitted and should be working quite freely but without any looseness.

After the gear has been assembled and fitted to the frames, put on the valve chests (without the covers) with the valves and valve-spindles in place. Connect up the radius rods to valve-spindle crossheads, but do not put on the gear connecting rods yet. The return cranks have already been fitted, but are not yet fixed.

If the engine has outside valve gear, steps should be taken to check on the setting of the valves and to ensure correct events. Time spent at this point in the reassembly is well worth while; it is amazing what a difference correct valve setting will make to an engine that was sluggish, and a poor performer, owing to unreliable valve setting.

Set the curved link (or the corresponding sickle-rod of a Baker gear) in such a position that the reversing shaft can be moved throughout its range without imparting any movement to the radius rod and valve spindle. Fix it in this position with a strip of steel clamped to the frame, and you are ready to adjust and fix the return crank in position. Wheel the chassis along the bench until the main crank pin is exactly at front dead centre, and set the return crank as nearly as you can. Measure the distance with a pair of dividers between the crank pin and the eye of the link. Wheel the chassis back until the main crank-pin is at back dead centre, and see if the distance is the same as before. If it is not (and probably it will not be) shift the return crank a little in the appropriate direction and try the whole process again, until the distance between the crank-pin centre and the centre of the pivot hole in the tail of the link—or whatever corresponds to this in your own particular valve gear—is identical whether the main crank pin is at front or back dead centre.

Rods at fault ?

Secure the return crank by the clip-bolt, or by drilling through and putting in a taper pin (much the better way). The last measurement taken by the dividers shows the correct distance between the pin holes of the connecting rod, and so it will be as well to check this before fitting it. The length is most important for the correct setting of the gear. Should your rods be at fault here, I am afraid there is nothing for it but to make new ones.

Before we can proceed, the gear lever should be examined. If a wheel-and-screw is used, probably the only thing which needs checking will be the pivot-pin to which the reach rod is attached. See that there is no slack at this point. In the case of a quadrant lever, serious wear can have taken place, particularly in the latch mechanism. See to this, and eliminate as far as possible any fore-and-aft movement of the lever when the latch is lowered into position. Check also for looseness in the pivot pin and the reach rod fork.

Connect up the reach rod, and put the lever into mid-gear position. In this position the die-blocks should be exactly in the centre of the vibrating links. Test by wheeling the chassis backwards and forwards; if the gear is Walschaerts or Baker the radius rods should not move at all. The reach rod may have to be adjusted for length if this is not correct. Fortunately, most reach rods have a slight set or curved portion: this will allow us to make alterations quite easily in the distance between the forked ends.

After checking the length of the reach rod, connect it up to the valve gear, and wheel the chassis backwards and forwards, watching the movement of the valves at the same time. In mid-gear, if the valve spindle is of the correct length, the valves should open equally to lead opening at each end of the stroke. If this condition is not observed, assuming that all the checks already described have been carried out, it can only mean that the valve spindle is not of the correct length; in other words, the cross-nut or buckle needs adjustment. In most engines this adjustment is easily carried out by turning the spindle in the nut. If your spindle has a 40 t.p.i. thread, you have a minimum adjustment of 1/80 in., which is not accurate enough for many people. A good plan is to scrap the cross-nut and make up a new nut as shown in Fig. 1, opening out the slots in the top of the slide valve to suit. Two steel nuts on the valve spindle are used to adjust the position of the valve—they may be locked when the adjustment is correct.

Another neat device was described in ME many years ago. Make up a crosshead as shown in Fig. 2. It will be noticed that the spindle sheath is split with a saw-cut, and a clip-bolt fitted. This bolt serves two purposes: it prevents fore-and-aft movement of the valve spindle which has a semi-circular groove turned in it, and it locks the valve spindle to prevent it from turning after all adjustments have been made. The fitting is used, of course, in conjunction with a threaded cross-nut. Adjustments are made by loosening the clip-bolt nut, and turning the valve spindle, which should be provided with a couple of flats or a small cross-hole to take a tiny tommy-bar.

When you are satisfied with the valve-setting, put on the valve chest covers, connect up the oil pipes, and so forth, put on the running boards, and fit the oil pump to the frames, or on the running boards, so that it can be adjusted.

Most oil pumps are operated by a ratchet gear, worked from the valve gear, or some other appropriate point in the motion work, by a connecting rod. The ratchet gear has two essential elements: a moving pawl, mounted on a vibrating lever which pivots on the pump crank-spindle, and a fixed pawl, mounted at some point on the oil tank, the purpose of which is to prevent the ratchet wheel from moving back after it has been turned forward by the moving pawl. Imperfect action of the ratchet gear is a common fault. For reliable working, the ratchet lever should move through such an arc that not only is the fixed pawl made to click, but a little excess movement beyond this point takes place. The pawls should pivot quite freely. The pawl springs should be strong enough to ensure that the pawls seat positively into the teeth of the ratchet wheel, and the pawls themselves should fit down snugly into these teeth.

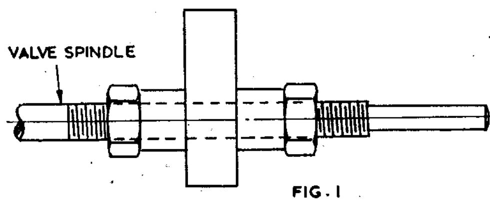


FIG. 1

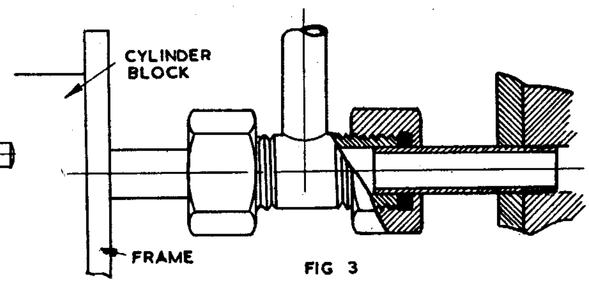


FIG 3

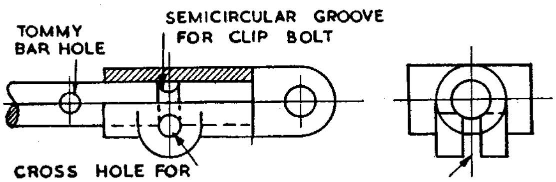


FIG. 2

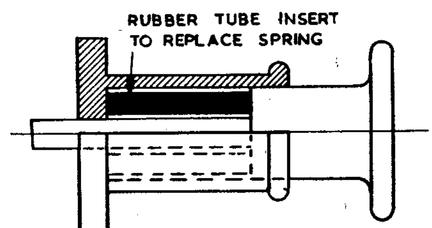


FIG 4

Adjusting ratchet gear

Check all these details before adjusting the ratchet motion. Above all, make sure that the connecting rod provides sufficient movement to the ratchet lever. It should be long enough to ensure that the arc through which the lever swings should first cause the moving pawl to click, and then the fixed pawl, with a little movement to spare at each end of the stroke.

After refitting brake gear, drain-cock rods, and other items, we can turn our attention to the bogies and trailing truck, if any. Usually bogies show very little sign of wear, but they are apt to collect dirt which forms a gummy deposit over everything. A good clean will reveal whether any of the bearings or springs need seeing to. Remember that, as the bogies are usually comparatively lightly loaded, soft springing is essential, coupled with ample up-and-down movement. A tendency to derail can often be cured by increasing the height of the horn slots in the bogie frames, allowing the axleboxes to move more freely in a vertical direction. Most of us do not use side-control springs on the smaller engines; we rely on the friction between the stretcher plate and the bogie bolster. So see to it that the adjustment of the king-pin nut provides just sufficient friction to give the necessary control.

If there is a trailing truck or bogie, or a fixed trailing axle under the firebox, it is almost certain to show signs of wear. It works in a mixture of oil and ash, and the axleboxes are apt to become very loose in the horns. It will probably be quickest to replace the axleboxes. While the firebox end of the frame is receiving attention it is as well to examine the draw-bar pin and its housing: it gets a lot of wear!

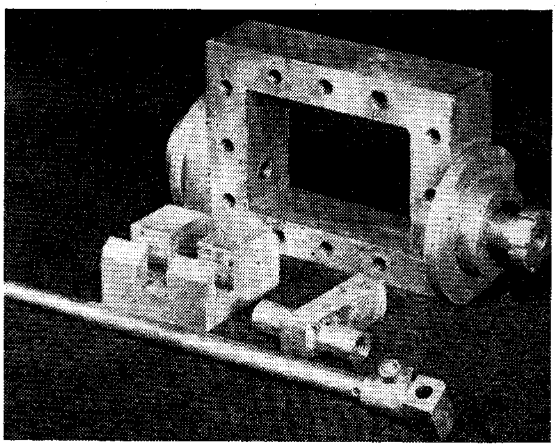
We now have to make the steam and exhaust connections. The usual screwed joints, with a running sleeve, plumber's fashion, although quite satisfactory in use, may be rather awkward to manage in the smaller sizes. I prefer packed gland joints (Fig. 3). The stubs are screwed into the cylinder blocks, or valve chests, before they are mounted on the frames;

the sketch is self-explanatory. All you have to do is tighten up the glands to make perfect steam and exhaust joints.

The saddle and smokebox can now be replaced. See that the chimney liner, blast nozzle, and blower jets are in correct alignment (a supply of compressed air can be useful here) and have a look at the condition of the crossbar and dart assembly, or whatever fittings you have for keeping the door closed tightly.

I do not know whether you would like to repaint the boiler before it is mounted on the frames, or whether, like myself, you want to leave the repainting of the whole engine until possible to buy plastic tubing with a stainless steel reinforcing coil moulded in it, suitable for pressure feeds, such as the connection from the tender hand-pump. If there is a pump in the tender it usually gets neglected, and fails to do its job when required owing to wear in the lever system, sticking ball valves and so on. Now is the time to fit a large plate, which is easy to remove on the top of the tank, if your tender does not have one already. The hand pump is likelier to be properly looked after when you can get at it easily, and consequently it will not let you down.

The levers, links and pins which work the tender hand-pump are sub-



Split-sheath cross-head with other parts of the valve-chest

it is all in one piece. Anyway, the boiler can now be replaced and everything connected up to everything else. Replacing the cab (new Perspex windows needed ?) and footplating should more or less complete the overhaul of the engine itself.

Examining tender

The repainting will, of course, include the tender, but before this is begun one or two of the mechanical features should be examined. Take off the tender tank, remove any strainers—if they unscrew, as they should—and clean them. Dismantle and clean out water valves. Take off rubber feed pipes: they should always be replaced at the end of the year in any event. A perished rubber tube is a frequent cause of injector failure because it allows air to be sucked in with the water, and the leak is more often than not out of sight underneath the tender or footplate.

I have replaced all my own feed pipes with plastic tubing, obtainable in most sizes from the local ironmonger's. As far as I am able to tell, this tubing does not deteriorate in the same way as rubber. It is also jected to comparatively enormous strains in times of emergency, and you will find that stainless steel has many advantages here. The general overhaul provides a good opportunity to replace the ram, and all those worn-out brass links, levers, pins and sockets with stainless steel. Most of us have a few lengths of round stainless steel in stock: the flat parts can be cut from any old piece of stainless steel plate which is bound to be found in the scrap box. It can be silver-soldered quite nicely.

Hand rails and columns throughout the engine may also be replaced with stainless steel rods. Renovate or replace any fittings on the outside of the tank (and on the engine) such as footsteps, which have become damaged, bent or even lost. These ornamental fittings get terribly rough treatment on the track, and are best reduced to a minimum. If they are indispensable to the appearance of the engine and tender, they may as well be in good order. Before refitting the tank, give it a good wash out.

Finally, the tender chassis must be given attention. The axleboxes usually collect oily dirt, which causes wear, and they will probably need the same treatment as the main axleboxes. Make sure that the springs are not too stiff: when the tender is resting on the track with normal load, none of the axleboxes should be bottoming on the hornstays; all of them should be riding on the springs. A single stiff spring is a frequent cause of tender derailments.

Draw gear

It is often forgotten that the buffers and draw-hooks—particularly at the rear end of the engine—have to do a full-size job although a scale appearance must be preserved as far as possible. Most of us have an ever-present fear of the engine's breaking loose and careering away down the track without the driver's restraining hand on the regulator. Examine the draw-hook anchorage, and make sure it is still good. As for buffers, most of them bottom too easily and too hard to be of any real use. I have tried using stout rubber tubing inserts to replace buffer springs (Fig. 4) and they seem to be very satisfactory in service. The tubing should not be a tight fit in the buffer body, but should be cut full length so that it is a little compressed at the normal position of the buffer. It is true that the buffer still bottoms when the rubber is fully compressed, and fills up the housing, but the effect is very much like that of a hydraulic compression system, and certainly takes up shocks better than springs of insufficient strength.

The locomotive steam era may be coming to a rapid end but there is no sign whatever that the fascination which the small passenger-hauling steam engine exerts on the model engineer and the general public is on the wane. In fact, the demand for tracks for local fetes seems to be on the increase. Long may it continue to be so. ▣

SEALING OF THREADED PIPE JOINTS

A very simple and efficient means of sealing screwed pipe joints is provided by the use of PTFE tape. A layer of tape is simply laid tightly round the male thread before the joint is tightened in the usual way.

A small amount of cold flow under pressure allows the tape material to take up the shape of the threads, even if they are imperfectly formed. The tape does not gall or seize, and because of its low coefficient of friction, joints are easily tightened they can easily be broken down after a long period of time.

Joints can be made effective over a wide temperature and pressure range and the sealing material is inert to all chemicals except molten alkali metals and gaseous fluorine.

Manufactured (as "Thredseal" Tape) by Crane Packing Co. Ltd, Slough, Bucks.

Machining difficult castings

By GEOMETER

A SMALL lathe, because of its size, and the fact that it is often the only machine tool in the workshop—or at least the major one—may have to work near the limit of its capacity more frequently than its production counterpart. It is a circumstance that poses problems for the owner, and puts a considerable premium on his skill in dealing with the larger components of a model or piece of equipment, when a small machine may be actually at the point of overloading.

With a little more power in the drive, a larger spindle, a wider bed, and a longer saddle, what in existing conditions is something of a struggle would be a walk-over—though there is always satisfaction in achieving one's ends in the face of drawbacks.

In dealing with a large casting, like that for a flywheel, conformity with general procedure for such a component, and some preliminary attentions to the lathe, help materially in overcoming difficulties. A firm set-up is a prior concern, and so if the casting is held in the chuck it should be at its rim rather than on its boss. If it has holes or spokes, it can be clamped to the faceplate—with packing interposed for proper butting-up. Slackness should be adjusted from the spindle bearings, and backgear engaged.

As most of the machining may be done with the cross-slide and top slide, their action may be stiffened by adjustment. Brought into position, the saddle can be adjusted almost to be clamped to the bed, and given support against thrust by engaging the leadscrew nut.

The material of tools, its heat treatment and grinding, and the cutting angles employed, are similarly factors of considerable importance to trouble-free working. Something better than ordinary silver steel or cast steel tools is advisable for machining hard cast iron, and a few tools of special material are never a bad investment. Various makes are obtainable, and all are tougher than carbon steel and less easily damaged by heat in use. Nevertheless care should be exercised in their grinding; and in their mounting, the axiom is, of course, as always—minimum overhang.

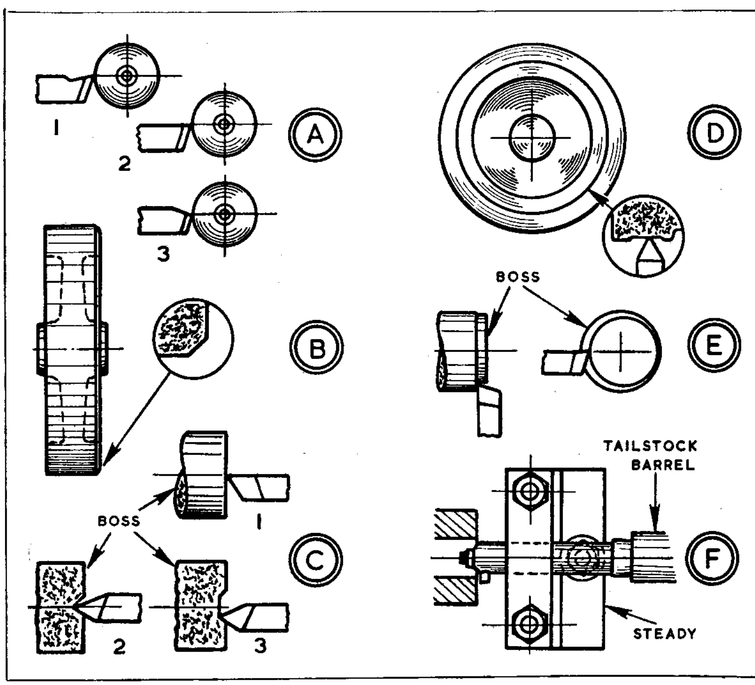
In general use, a turning tool carries top rake, as at *A* (1) to assist free-cutting from the sharp point given by the front clearance angle. But such a point is weak, for tough materials, and likely to overheat on those that are hard. Consequently, a tool with zero rake (2), or even one with negative rake (3) may be used with advantage on a hard casting—if only for the early cuts, until scale and skin have been removed.

Work with a suitable file, or on a grinder, to remove roughnesses and casting irregularities will save a tool from damage in scraping a rough surface; and if there is sufficient material, a small chamfer can very well be made at the edge of a rim, as at *B*, for the tool point to enter clean metal. Another way is to dig below the surface of a casting with a pointed tool, which can be effectively done on a boss, as at *C*. Instead of facing from the outside to the centre, scraping the tool edge during the early revolutions, a point tool at centre height (1) can be forced in (2) at minimum surface speed, then drawn out towards the diameter (3).

It can be done on the face of a rim, as at *D*, using a slow rotational speed, with a firm in-feed of the tool, and taking care that it is not entered so far that a ring will be left in the finished surface. Once started, the groove can be widened by facing feed until the ordinary tool can be substituted.

Whenever possible, a cut along a diameter, as at *E*, should be deep enough, even with wobble, for the tool edge never to scrape the surface—for only a definite hard spot is more damaging to a cutting edge than a gentle ramp of scale or skin.

The problem of a first cleaning cut in a rough bore can on occasion be solved as at *F*, using a fixed steady—orthodox or made for the purpose—close to the work, supporting a round boring bar which is fed from the tailstock.



TUG DETAILS

LIFEBOATS TODAY

They may soon disappear says OLIVER SMITH. Davits are already going

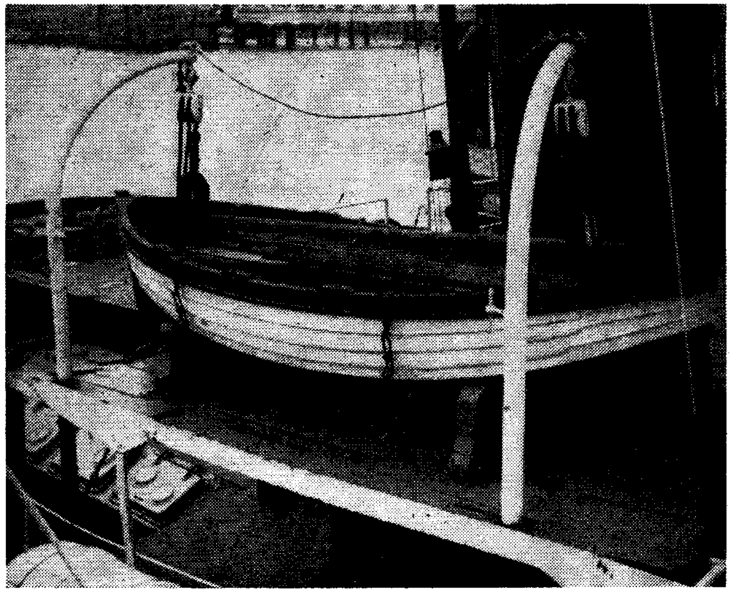


Fig. 1: Davits of s.t. HIBERNIA, *the oldest ship-towing tug on the Thames*

If there is one item in the equipment of a ship towing tug that could be singled out as having undergone the most changes, the lifeboats and davits would be well in the running. Of the two, the davits have been through so many stages that we are now at a point where they are being dispensed with altogether. And the lifeboat, too, may eventually disappear.

While the changes in the general design of davits is of great interest, we can also note the change in shape through the section, the position of davits on the ship and the method of operation. Lifeboats have not seen quite so many changes. The most important have been in the materials of construction. Where the early lifeboat was always built of wood, today aluminium, glass fibre, and plastics are favoured.

Fewer lifeboats

Another trend worth noting is the reduction in the number of lifeboats. Tugs in the fleet of a company which has always had a boat on the port and starboard side are now changing to a boat on one side only. It is certainly standard practice with the leading companies operating on the River Thames, and I have observed that it is adopted by others in different parts of the country. As the tugs which I have visited are the work of different shipbuilders, the change in design and layout is not the decision of a particular company. Tug owners who have always had their craft fitted with two lifeboats, and are now turning to the single boat, are installing an inflatable life raft in place of the boat that has been removed. Every tug in the fleet of Ship Salvage Ltd is being converted in this fashion with the exception of s.t. *Gondia* and *Kenia*, which are still licensed by the Board of Trade for carrying passengers.

I have discussed this with some of the skippers whose tugs have been effected and they have welcomed the change—particularly those on older craft which have a lower bridge than the more modern vessels. They strongly favour any change that assists in improving their view aft, the direction which occupies almost their whole attention when berthing a ship.

Selecting photographs of the different types of lifeboats installations posed me with a problem because I have so many. I have tried to show all the details that I can. They are from tugs that are in service today and they cover a period over the last 75 years.

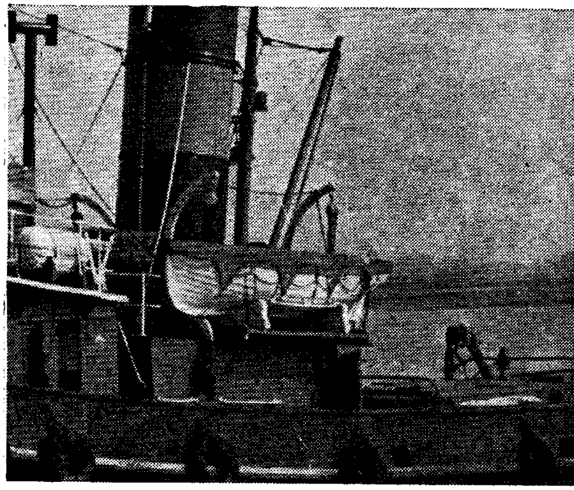
Fig. 1 is an example taken from the oldest ship-towing tug operating on the Thames. Followers of these notes will recognise the s.t. *Hibernia*. The davits, round in section, are of a very simple and straightforward design, it is typical of those on a veteran craft still very actively engaged in most ports. The method of launching is familiar to most readers: the davits swivel in their position so that the lifeboat can be passed between them.

A completely different type of installation is shown in Fig. 2. This picture was taken of s.t. *Kenia*, built in 1927 and sister ship to the *Gondia*. The lifeboat is made of wood and is a much improved one compared with *Hibernia*'s. In addition to two lifeboats, the ship has an inflatable raft, clearly seen on the bridge just behind the port navigating light. I am preparing some drawings of an installation similar to this one.

Modern design

From 1927 we jump to 1955 for our next example, Fig. 3. The davits are entirely different from the others we have seen. They represent a good example of modern design. The flood light at the top of the forward davits is worth noting. Readers following the *Moorcock* series may be interested to know that a similar type of lifeboat is fitted to that tug. The lifeboat is constructed from aluminium. Behind the samson post which is obscuring part of the stern of the lifeboat can just be seen part of the inflatable raft.

At the time of writing the tug *Ionia* has not completed her first month of service with her owners, William Watkins Ltd; the glass fibre lifeboat (Fig. 4) is positioned aft of the funnel athwartship and it certainly improves the field of vision from the bridge. When I went on board, the master, Mr F. Morgan, expressed his pleasure



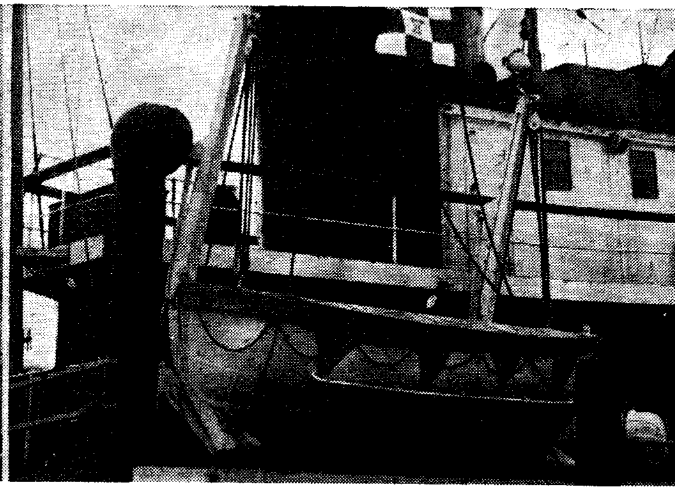


Fig. 2: *s.t.* KENIA *has two lifeboats and an inflatable raft*

Fig. 3: *By* 1955 *davits had changed considerably*

in having the lifeboat tucked away like this. It certainly gave him a commanding view; the only object in the way was the funnel, and as I am one of those who like funnels I hope it will not disappear for a long time yet.

The lifeboat is launched by a small crane placed on the starboard side. It is hand-operated, both for lifting and slewing. As with the davit in Fig. 3, a flood light is fitted to the top of the jib.

Although I have only touched the edges of a very wide and interesting subject, the illustrations do show to some extent the variety that exists in design and operation. This fact should give a lot of pleasure to those who design and build their own models, for here exists a real wealth of material.

But if the model was built around a tug of a particular period, great care would have to be exercised to see that it was fitted out correctly. With so many varying designs over the last 60 years, a mistake could be easily made.

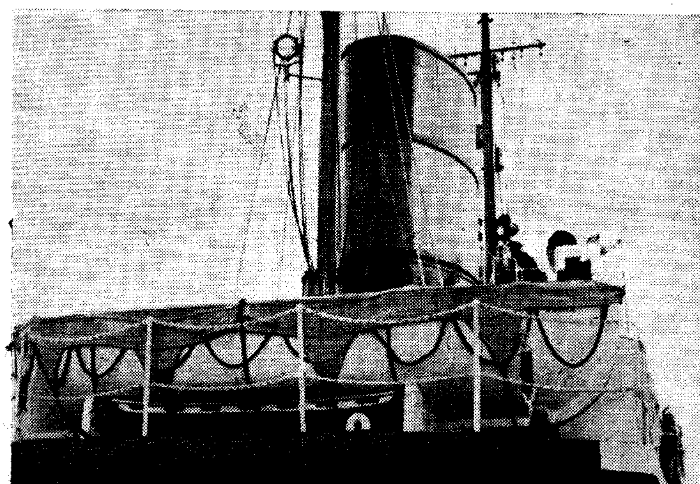
To some readers this changing from one to another may be very confusing and perhaps disheartening in the search for precise information. I admit it is difficult, but I am hoping that through the series I can help.

At present I am preparing some drawings showing some early installations and methods of operation. Also there will be a drawing in which the builders of *Gondia* will be particularly interested. It shows how lifeboats and davits are fitted and operated on this tug.

To the best of my knowledge this information has never before been published. So here is something for enthusiasts who wish to improve their model of this tug before the next season begins.

Incidentally, I am always ready to deal with problems which might arise in the construction of model tugs, and if any builder requires technical information which he cannot obtain through the normal channels I will do my best to help.

★ *To be continued on October* 6



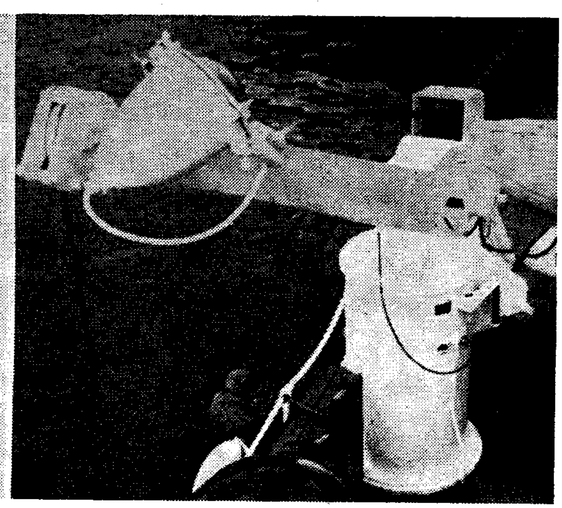
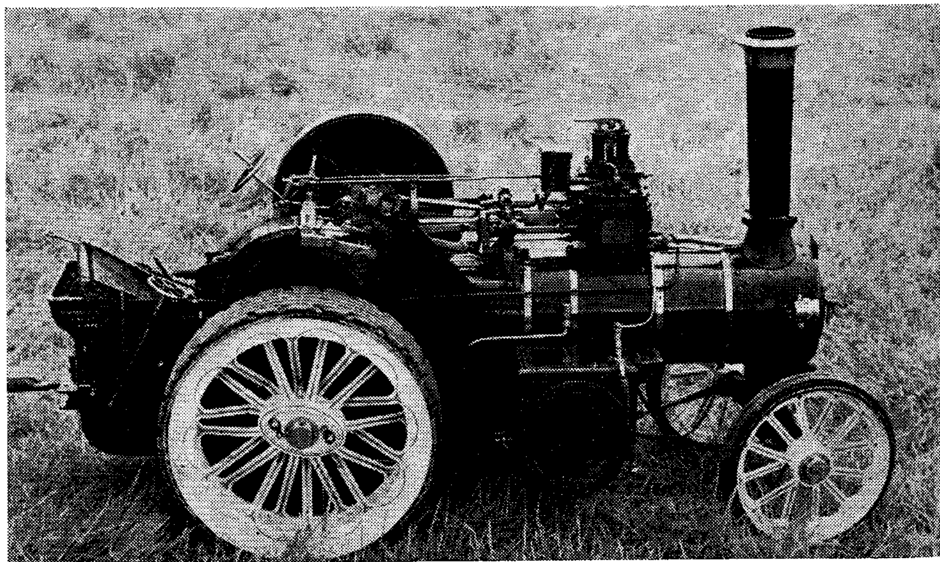


Fig. 4: *Left, fibre glass lifeboat. Right: crane in stowed position*

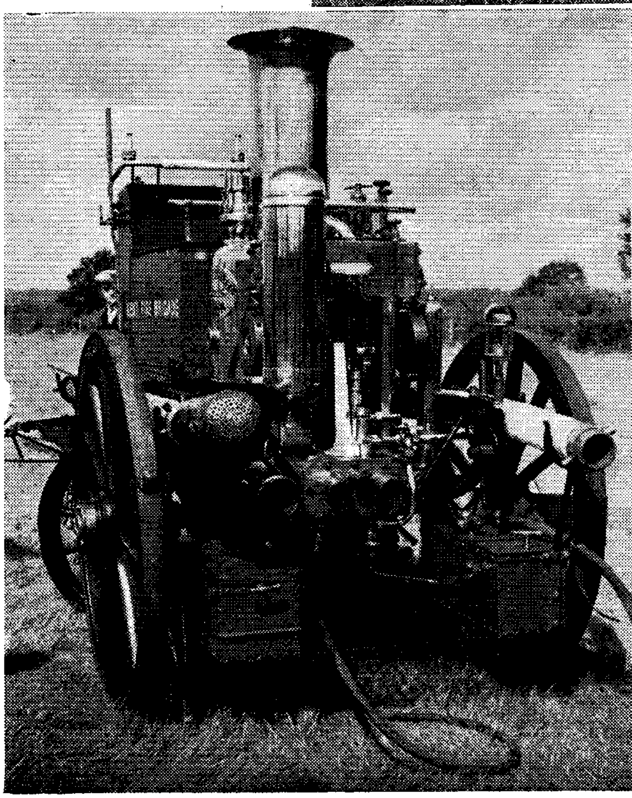
1

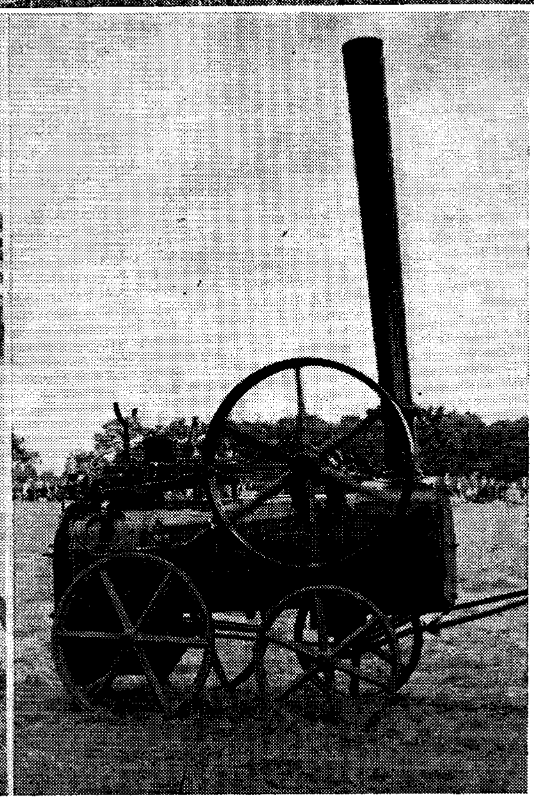
POWER AT PENSHURST

Steam in the brave old style comes to the Kent village where Sir Philip Sidney was born

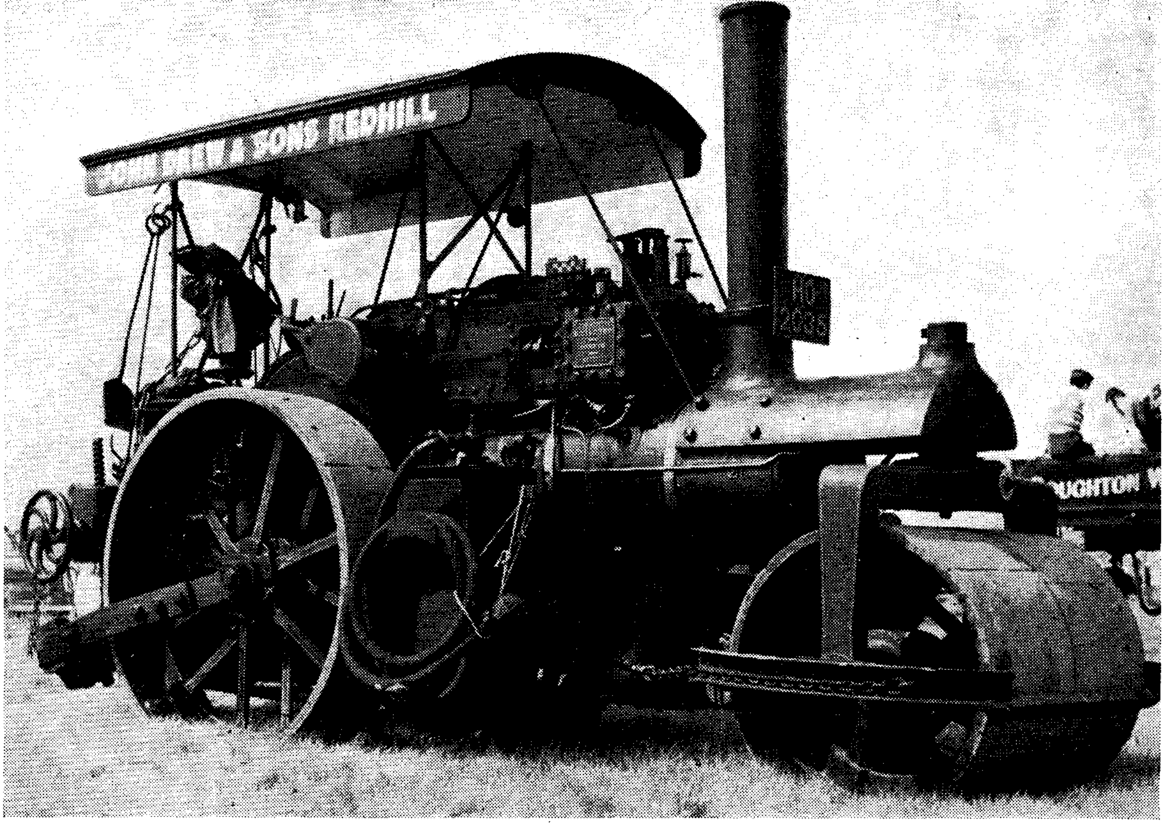


This 3 ft miniature Burrell at the Penshurst Rally was driven by Mr R. Winsford of Banstead near Epsom





Left: In 1913 Bromley Fire Brigade bought a new Shand Mason double vertical engine for £450. *Here it is, two world wars later, at Penshurst Rally. It is* 24 *h.p.,* 125 *p.s.i. Pumping* 260-300 *gallons a minute, it produces a jet* 150 *ft high from a* 1 *in. nozzle. Right: Miniature Brown and May*



Wallis and Steevens 8-*ton compound oil-bath roller No* 7572, *built in* 1921, *is a converted tractor formerly owned by Messrs Ernest West of Burgess Hill, Sussex. It was bought last year by John Drew and Sons of Redhill in Surrey*

---

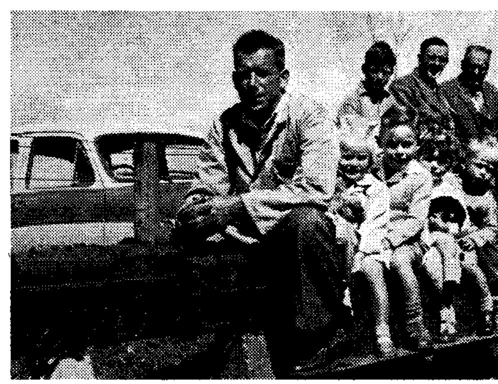
2 Canterbury NZ Show

OUR long-awaited track and opening day had caught up with us at last. After talking about it for years, we finally screwed up our courage.

We gave the exterior of the club house a coat of paint and the interior a good clean out to make way for the shelving erected to hold the seventy models. Advertisements were placed in the newspapers, hand bills were printed and distributed, kindred clubs to the north and the south were invited to come and bring their locomotives, and the very necessary insurance was arranged. The track was treated with anti-corrosive, the concrete piles were painted, barricades were erected at strategic points around the track, and a fence was built in front of the steaming-up bay.

In this part of the world we have no difficulty in getting good coal. It is linton, a lignite that burns away to a soft white ash and has no tar to foul the tubes. Two compressed-air plants were lent by members for running models in the exhibition, and steam-raising gear was arranged.

Visiting club members helped us on the track, Harry Fittis came 200 miles from Blenheim with his 3½ in. Britannia, and Tom Mountford was 100 miles from home, as he had come from Timaru to help. Ron Duncan with his 2½ in. NZR Ab type locomotive and Stan Vernon with Monty Thompson's NZR Ja type in 3½ in. gauge did great service after travelling 230 miles. Together with a *Princess Royal*, an NZR Kb in 2½ in. gauge and a 3½ in. Ab (also a NZR type) a 3½ in. Britannia, two *Juliets* and a 5 in. freelance tank, kept up a continuous passenger hauling service. Our track is 13 laps to the mile in the usual 5 in., 3½ in. and 2½ in. gauges.



"*Golly had a ride too.*" *Harry Fittis takes a happy passenger load*

The exhibition of models in the clubroom was well patronised—too well at times. Wives of club members, assisted by Mrs Fittis and Mrs Mountford, supplied many welcome cups of tea and light meals. New Zealanders are very fond of a cuppa.

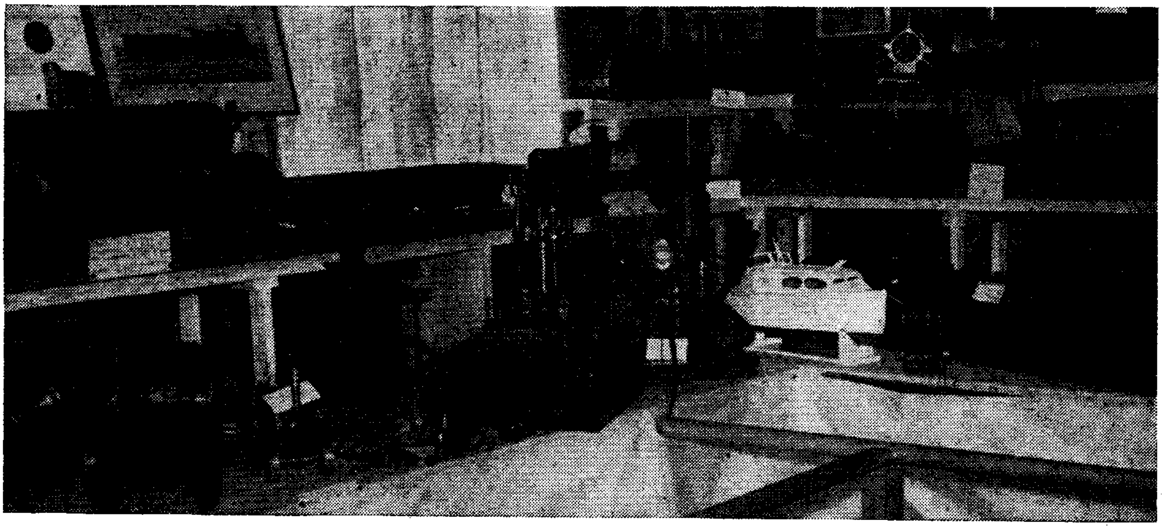
Among the exhibits we had a 5 in. gauge Dunalastair in the making, alongside a *Titfield Thunderbolt* in the same state. Another exhibit showed the evolution of a locomotive wheel made by fabrication. Visitors also saw an Allchurch Royal Chester in the making, a 1939-45 field gun, a small traction engine made by a member who has only one arm. Components of a completely fabricated ME 1831 engine, and a vertical engine and boiler. The ME beam engine ran on compressed air while on the floor was a 1¾ in. scale Fowler traction engine which ran around the grounds. An *Ayesha* tender and a model of the Christchurch Tramways old steam tram stood in a corner close to a dividing attachment, a three-point steady, and a boiler for a 3½ in. Ab locomotive. On another shelf was a nearly completed Britannia built to this stage in only two years of spare-time work, and below it was a 30 c.c. two-stroke engine belted to a generator supplying electricity to a searchlight.

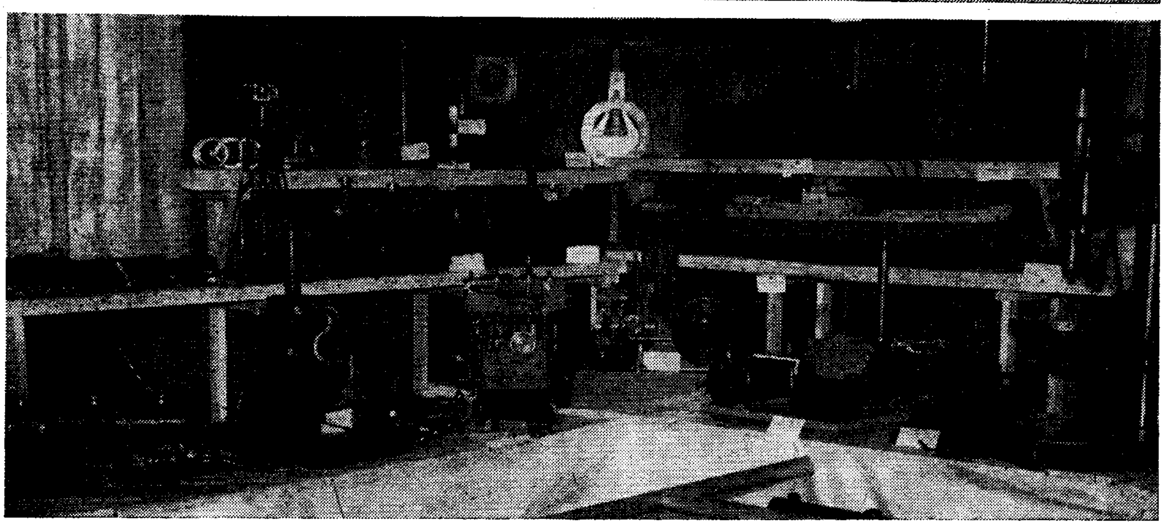
Various small pieces of workshop equipment were shown on a top shelf with a vertical engine and a chapter ring and pendulum suspension for a Westbury clock being made by a member who has only hand tools. There, too, was a 2½ in. *Ayesha* and an undertype engine and boiler. Below stood a windmill by our one armed member, two *Maisies* in course of construction, a 1 in. scale traction engine and fruit ship with steam power plant. A lower shelf held another *Ayesha*, the present Moody Cup holder, together with a vertical steam power plant and a compound marine engine (described by Axle in the ME about 1924).

We had a freelance gas engine, and a horizontal engine and boiler. Behind a twin Tangye was a small portable, by the modeller with one-arm. Castings for the twin Tangye were obtained from the Liverpool Casting Company many years ago and the construction was described by Mr Ballantyne in MODEL ENGINEER.

One model, of a beam engine, came to New Zealand about 100 years ago and at times sounded like it. Not far away was an ME road-roller.

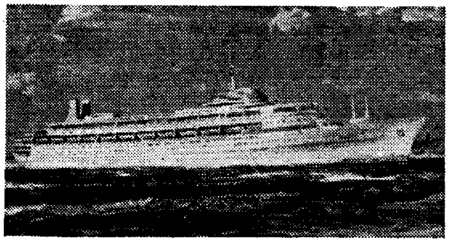
Altogether it was a representative show.—HARRY POWELL.





Visitors from many parts of Canterbury returned with tales of what they had seen in Christchurch. There was a great variety to remember

Build a prize-winning model of



Canberra

Continued from 8 September 1960, pages 294 to 296

IN THIS THIRD INSTALMENT EDWARD BOWNESS ARRIVES AT THE PREPARATIONS FOR THE LINER'S SUPERSTRUCTURE

On re-reading my second instalment I find that I was a little vague about the cutting of the upper surface of the block for the promenade deck. Actually, the surface of the deck is 7/64 in. below the uppermost line of the profile in the ship's lines on the plan. This line, as is noted on the drawing, is the rail around the promenade deck. From the stem-head and aft to Station 19 the line shows the upper edge of the bulwark, and up to that point the block should be cut square across along this line.

Just aft of Station 19 the bulwarks are curved down to within 1/32 in. of deck level in what is known as a "hance." These low bulwarks continue aft to Station 17 (see elevation of ship on plan). The deck between Stations 17 and 19 should be cut down on $\frac{1}{16}$ in. below the level of the rail along the centre-line of the vessel, and from there curved downward toward each side to represent the camber of the deck (see Fig. 10). The dotted line from Station 17 to the stemhead shows the level of the deck at each side of the ship. As the ship narrows forward the camber becomes less and less until it is finally lost.

The deck forward from Station 19 should now be cut out, cutting down on each side to the depth shown by the dotted line, which indicates the diminishing amount of camber toward the stem-head. The forward sweep of the stem outline and the flare along each bow should be followed on the inside of the bulwarks, making the bulwarks as thin as possible along the upper edge, but a little thicker at the deck.

Some ship modellers prefer to add the bulwarks after carving the deck, but it is extremely difficult to get the correct shape for the strip, and still more difficult to persuade the strip to follow the curve of the bows and at the same time match up with the flare along the sides. To carve it from the solid calls for sharp tools, a delicate touch, and great patience, but the method gives the best results. Showing the camber of the deck in this way, although it gives the model a better appearance, may be considered an unnecessary refinement, and if so it could be ignored completely and the deck be cut flat across throughout. A simpler job neatly done is, after all, better than an attempt at something beyond one's powers.

From Station 17 and aft to the stern the deck should be cut square across along a line 7/64 in. below the rail line along the top of the profile. This is the level of the deck proper; while it flows in an easy curve fore-and-aft in our model, it should be cut flat across from side to side, ignoring the camber completely—because the superstructure is built in layers which have to be curved to the sheer line of the ship, and it would be impossible to bend the layers both transversely and longitudinally. An overlay of Bristol board will be used around the stern and along the sides; as this forms the bulwarks or rail, it permits of the sides being cut away flush with the level of the decks.

The half-size drawing (pages 364-5) shows plans of the upper decks. This is the actual size for the smaller of the two recommended scales. Prints of the drawing, obtainable from PM Plans Department, are to 1/32 in. scale, which is the scale of the larger model and can, therefore, be used for tracing the layers when cutting out.

The shaded portions give the shape of the wooden blocks which represent the cabins on the various decks. From a study of the promenade deck it will be seen that the cabin proper overlaps Station 17 about 10 ft (to scale). The raised portion of the deck which represents the camber should be cut away to clear the cabin, or, alternatively, it should be bevelled off and the underside of the cabin bevelled off to correspond. Great accuracy is not necessary as the work is enclosed by the curved front of the promenade deck which is added later. The important point is that the layer representing the cabins on this deck should lie flat on the deck without rocking. The curved front will be fitted to the camber of the deck, as we shall see.

The usual method of building up the superstructure in a model of a modern liner is to make the cabins of blocks of wood of the correct shape and thickness, and to interleave them with Bristol board or very thin three-ply, or even plastic sheet, to represent the overhanging decks. The thickness of the wood, plus the card or other deck material, must equal the height from deck to deck for the scale of the model.

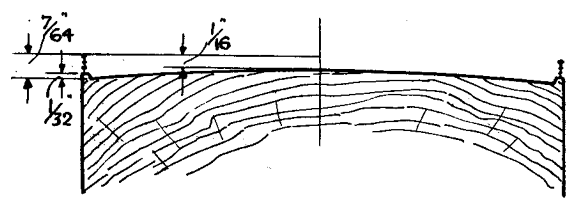
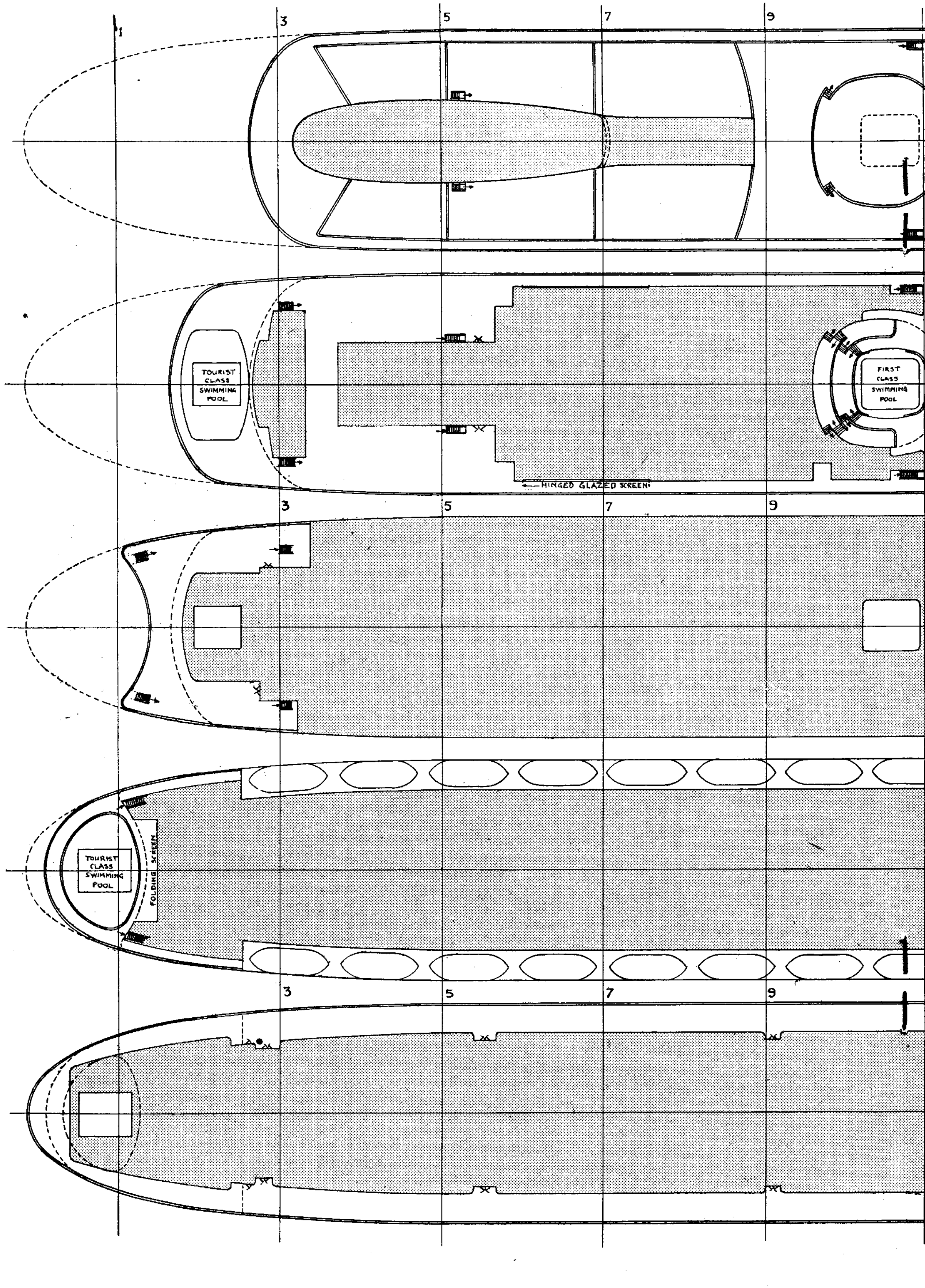


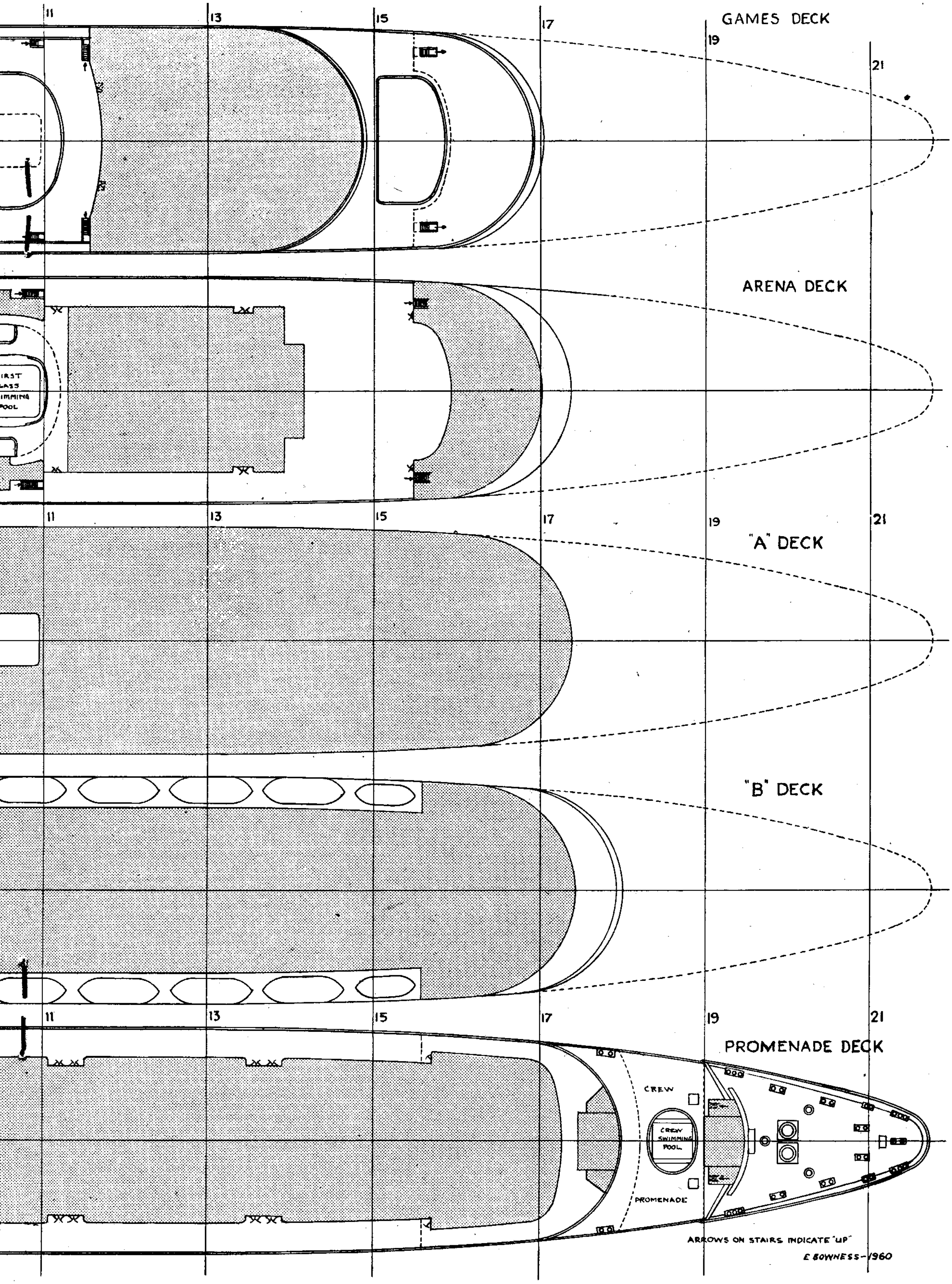
Fig. 10: *Section showing camber of deck*

Model engineer receives many enquiries about Bristol board. It is good quality cardboard with a fairly hard, smooth surface, specially made for artists using pen and ink. It can be obtained at most artist's supply shops and is sold in different thicknesses, two-sheet, three-sheet, and four-sheet being the most common.

● *Continued on page 378*



1
3
5
7
9
TOURIST CLASS SWIMMING POOL
FIRST CLASS SWIMMING POOL
HINGED GLAZED SCREEN
TOURIST CLASS SWIMMING POOL
FOLDING SCREEN



GAMES DECK
ARENA DECK
"A" DECK
"B" DECK
PROMENADE DECK
11
13
15
17
19
21
POOL
CREW
CREW SWIMMING POOL
PROMENADE
ARROWS ON STAIRS INDICATE "UP"
E BOWNESS-1960

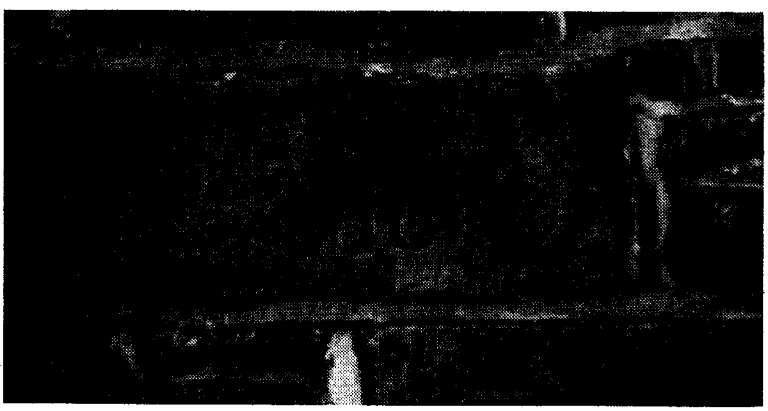
End of a MOORLAND RAILWAY

By William B. Stocks

Members of the Railway Correspondence and Travel Society pay their respects to Hepworth at a point near the junction with the main line in between Penistone and the Woodhead Tunnel

DURING the golden age of railway development in the mid-nineteenth century, certain industrial concerns at a distance from the nearest railway route would undertake the construction of their own branch line. About a century ago the newly-formed Hepworth Iron Company built a line about a mile and a half long, over the windswept Pennine moorland to connect with the Manchester-Sheffield line not far from Woodhead Tunnel. It exists today as a little line of picturesque appeal and antique interest which has reached the close of its active working life.

The Hepworth Iron Company came into being late in the 1850s with the object of working a suspected seam of iron ore. Beds of coal and excellent fire clay were found, and the functions of the business changed, though the old title was retained. It seems that the line came into existence in 1861; this date is to be found crudely cut in the masonry of a road bridge. Trucks were hauled up to the works by a stationary winding engine because of the fierce gradient on leaving the main line. Today the maximum inclination is 1 in 23, but when the line was opened it was even steeper. In due course a locomotive named *Polly* was obtained, and was eventually supplemented with a second engine which was named *Ebor*. Both these locomotives have been long since scrapped, and for many years now the traffic has been handled by two 0-6-0 side-tank locomotives, *Hepworth* and *Ebor*, the latter carrying the name plates from the first *Ebor*. *Hepworth* was built by the Yorkshire Engine Co., Sheffield, in 1905 and the second *Ebor*, was originally built by Hudswell Clarke of Leeds for the Barry Railway as long ago as 1889. After the amalgamations the engine became GWR No 781. It was sold by the Great Western to Robert Stephenson's in July 1932, and thence passed to the present owners. Both engines have always been very well cared for and have made a pleasant sight in apple-green and red.



Next year a century will have passed since this date was cut into the masonry of a road bridge over the Hepworth Railway

As may be imagined, the line abounds in interesting features. A tunnel, roughly cut through about a quarter of a mile of moorland shale, is only just large enough to allow the passage of the locomotives. Much of the track is laid with the chair keys on the inside of the rail, and the chairs themselves appear of considerable age. Near the works is a point-lever box with the cast initials on the cover plate "M.S. & L." (Manchester, Sheffield & Lincoln—the original title of the Great Central). It has been the practice for the locomotive in service to propel the wagons up the grade and into the works; five or six loaded wagons have been the maximum load for one movement.

Unforgettable experience

It is to the regret of everyone, including the owners, that the decision to close the line has had to be taken.

In recent years the line has been visited by parties of railway students. Some have come long distances to inspect the line and to ride over it in open wagons. Riding in this manner through the tunnel is an unforgettable experience—pitch darkness and a jolting wagon, dripping cold water from the innumerable springs above, and the din of the engine blowing off in the descent, or furiously blasting on the return trip.

Tribute must be paid to the constant and unfailing courtesy of the Hepworth Iron Company on these and all occasions, and to their friendly, cheerful engine driver. A small, but significant, chapter of railway history comes to its end. ▣

HIELAN' LASSIE

Continued from 8 September 1960, pages 303 and 304

By LBSC

Motorists might call the lubricator for this 3½ in. gauge LNER Pacific a V-twin. Its two pumps of different bores introduce something new in Lassie's construction

LASSIE's lubricator differs from anything hitherto specified in these notes in being what motorists would call a V-twin; it has two pumps of different bores.

As the inside and outside cylinders are supplied by separate connections to the hot header of the superheater, and there is no central steam distribution point outside the smokebox into which a common oil supply could be fed, it will also be necessary to split up the oil feeds. The uninitiated will probably wonder why oil could not be supplied by a single pump to a three-legged spider fitting and thence by separate pipes to each cylinder; but although this sounds feasible and would work up to a point, it suffers from a serious drawback. The oil delivered to the spider fitting would naturally be at a constant pressure during the delivery stroke; but as it would naturally take the path of least resistance when leaving the spider, all three pipes would have to be exactly the same length and internal diameter, and if clacks were provided at the entry to the cylinders the springs would all have to be of exactly the same tension. Otherwise the cylinder with a short pipe or a weak clack spring would get an extra supply of oil at the expense of the other two.

As I have found from practical experience that a pump, delivering into a plain tee with pipes of equal length to two outside cylinders, will feed satisfactorily, one pump in the twin will feed the outside cylinders only, and the other one will feed the inside cylinder direct. Naturally the inside one will not need as much oil as the two confreres outside; and so the pump feeding it can be made smaller in the bore. The two pumps work off one crank; and as the smaller ram or plunger needs a separate big-end bush to work on the crankpin, the two have to be set at different centres to allow the two rams to clear.

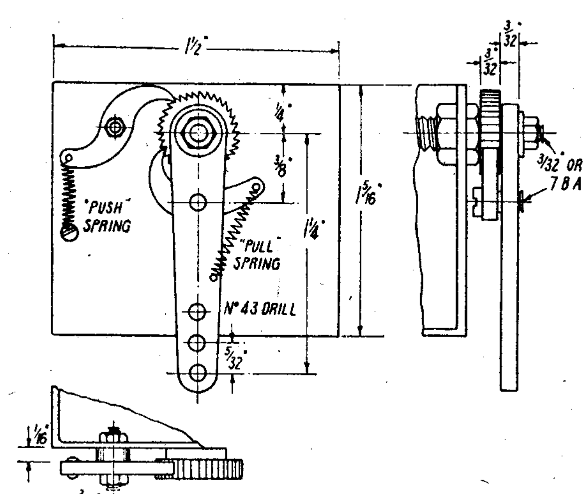
Oil tank

The simplest way of making the oil tank, is to cut a strip of 18 or 20 gauge sheet brass 6 in. long and 1 5/16 in. wide, and bend it into a rectangle with 1½ in. sides. Stand it on a piece of the same material a little over 1½ in. square, in your brazing pan; then silver-solder all around the bottom, and down the open corner. Pickle and wash off; then file the bottom flush with the sides, and trim off the corner which is joined, if it needs trimming.

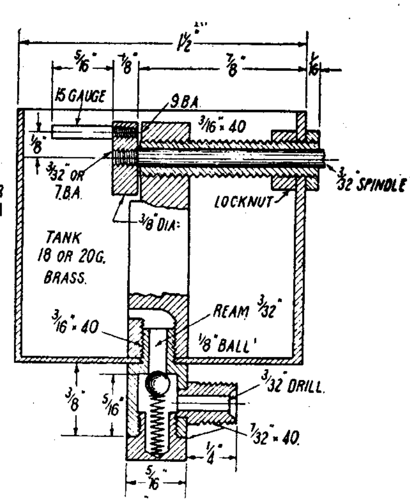
Scribe a line right across the centre of the bottom plate; make a centre-pop 3/8 in. from one side and 1/4 in. from the other; drill them 3/16 in. clearing. Drill another 3/16 in. hole, 1/4 in. from the top of the side that is to your right hand, when the tank is right way up and the holes in the bottom plate nearest to you. A snap-on lid can be made for the tank, by simply flanging a bit of 18 or 20 gauge brass sheet over an iron former 1½ in. square, taking a nick 3/16 in. square out of each corner, and bending 3/16 in. of each side at right angles, thus forming a shallow tray. The corners can be silver-soldered if you so desire.

Castings may be available for the pump stand, or it may easily be cut from the solid—saw and file to the shape shown, from a 1¼ in. length of 1¼ in. × 5/16 in. brass bar. Machining is the same in either case.

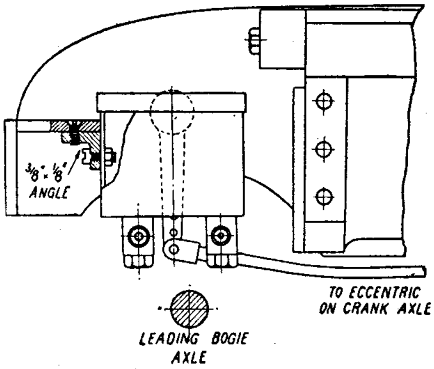
Beginners please note: all holes, except the oil inlets, should be drilled either on a drilling machine or in the lathe against a drilling pad on the tailstock; it is essential that the holes for bearings should go through dead square. At 3/16 in. from the apex, drill No 22 or 5/32 in., and tap 3/16 in. × 40 for spindle bearing. Locating from this, mark off the trunnion holes and ports to sizes given on the illustration; drill trunnion holes No 41 and ports No 53, these going only halfway through the



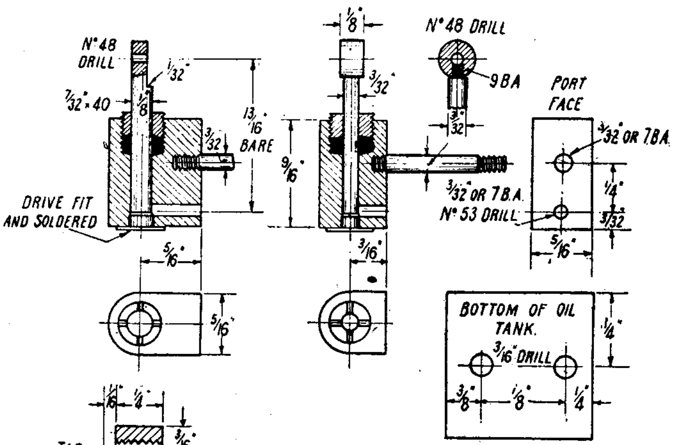
Ratchet gear



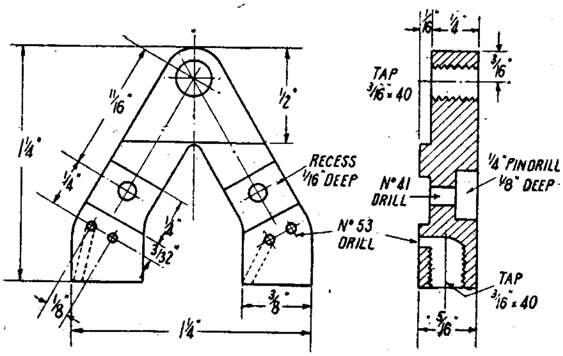
Section through bearing and check valve



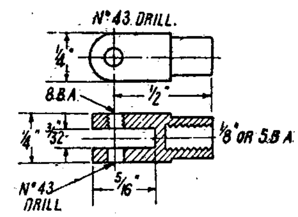
How lubricator is erected and driven



Details of pumps

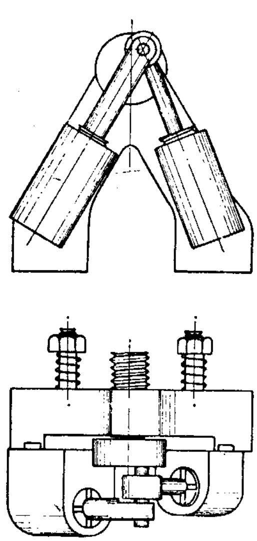


Stand for twin pumps



Driving fork

stand. Now note carefully: close to the left-hand edge of each foot or base, and about on the middle line make a centre-pop and from it drill a No 53 hole into the left-hand port, as shown in dotted lines. Then, with a rat-tail file, make a mouse-hole in the wall, so that oil can get into the duct when the stand is in place at the bottom of the tank. At $\frac{1}{8}$ in. from the right-hand side of each foot, about on the centre line, drill a 5/32 in. hole $\frac{3}{16}$ in. deep, and tap it 5/32 in. × 40; from the top of this, run a 3/32 in. drill into the right-hand port. That settles the drilling.


How pumps should look when assembled

Forming the recesses

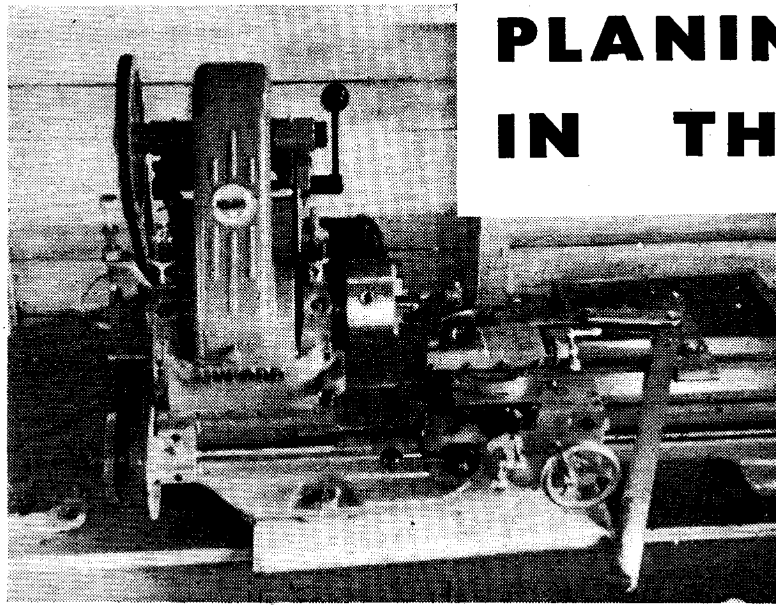
File or mill away $\frac{1}{16}$ in. of the face, from the apex to the point where the legs divide; then repeat on each leg, from a point 3/32 in. above the ports, to form a recess $\frac{1}{4}$ in. wide (see illustration). Form a circular recess, $\frac{1}{4}$ in. dia. and $\frac{1}{8}$ in. deep, at the back of each trunnion hole (see section); use a pin-drill. The raised portions left after the recessing must be truly faced; this is done exactly as described for the cylinder port faces; but if you are using a casting, rub it first on a smooth file. After facing, be sure to wash all the chippings and emery dust out of the ports and oil ducts; you are making a lubricator, not a valve and piston grinder !

The pump cylinders are simple to make. The bigger one needs a bit of $\frac{1}{2}$ in. × $\frac{5}{16}$ in. brass rod, and the smaller a bit $\frac{3}{8}$ in. × $\frac{5}{16}$ in., both $\frac{9}{16}$ in. long after both ends have been squared off in the lathe. On the centre-line of the narrow end make a centre-pop $\frac{5}{16}$ in. from the edge of the big one; chuck in the four-jaw with the pop mark running truly, and drill the big one No 33, following with $\frac{1}{8}$ in. reamer. Drill the small one No 44, and finish with 3/32 in. reamer. If you have no regular reamers of these sizes, get a couple of bits of silver steel about 2 in. long, file one end of each to a long oval, harden and temper to dark yellow, rub the oval faces flat on an oilstone to get rid of the file marks and any roughness of the edges—and you have the reamers.

Open out the ends of the bores to a bare $\frac{3}{16}$ in. depth with $\frac{3}{16}$ in drill—it pays beginners to make pin-drills for jobs where two holes have to be concentric—and tap 7/32 in. × 40. The glands are made like those on the engine cylinders. Use 7/32 in. brass rod, and make the glands about $\frac{1}{8}$ in. long; cross-nick with a saw or file.

Scribe a line down the middle of each port face, centre-pop it 3/32 in. from the end opposite gland, and also at $\frac{1}{4}$ in. above that. Drill the bottom hole No 53 piercing the bore. Drill the other one No 48 and do not pierce the bore; tap it 3/32 in. or 7 BA. Poke the reamers through again, to clean out any burrs, and

● *Continued on page* 371



PLANING GEARS IN THE LATHE

Eight shining wheels more than repaid A. E. SMITH for the time and effort which he had spent in making them

When I was considering the cost of building the $1\frac{1}{2}$ in. scale Allchin traction engine, I decided that nothing but castings would have to be bought. They were the only items entirely beyond the scope of my workshop.

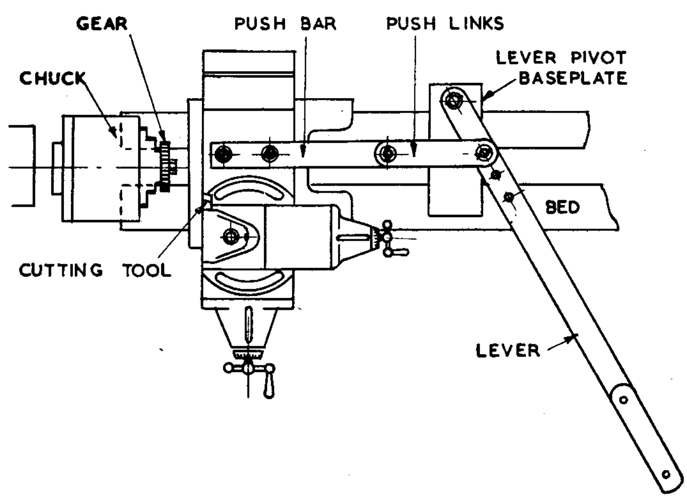
With this in mind, I began on the boiler, which was duly completed and tested. The hornplates were then made and temporarily fitted to the boiler. At this stage I was anxious to tackle something more mechanical that the tender, which was probably the next logical step. The gear wheels were rather expensive to buy and so I resolved to make them. Gear-cutting was entirely outside of my range at that time, as my only equipment was a ML7 lathe with standard equipment and a home-made drilling machine. After toying with various ideas I concluded that planing the teeth with a form tool would involve the least amount of special equipment.

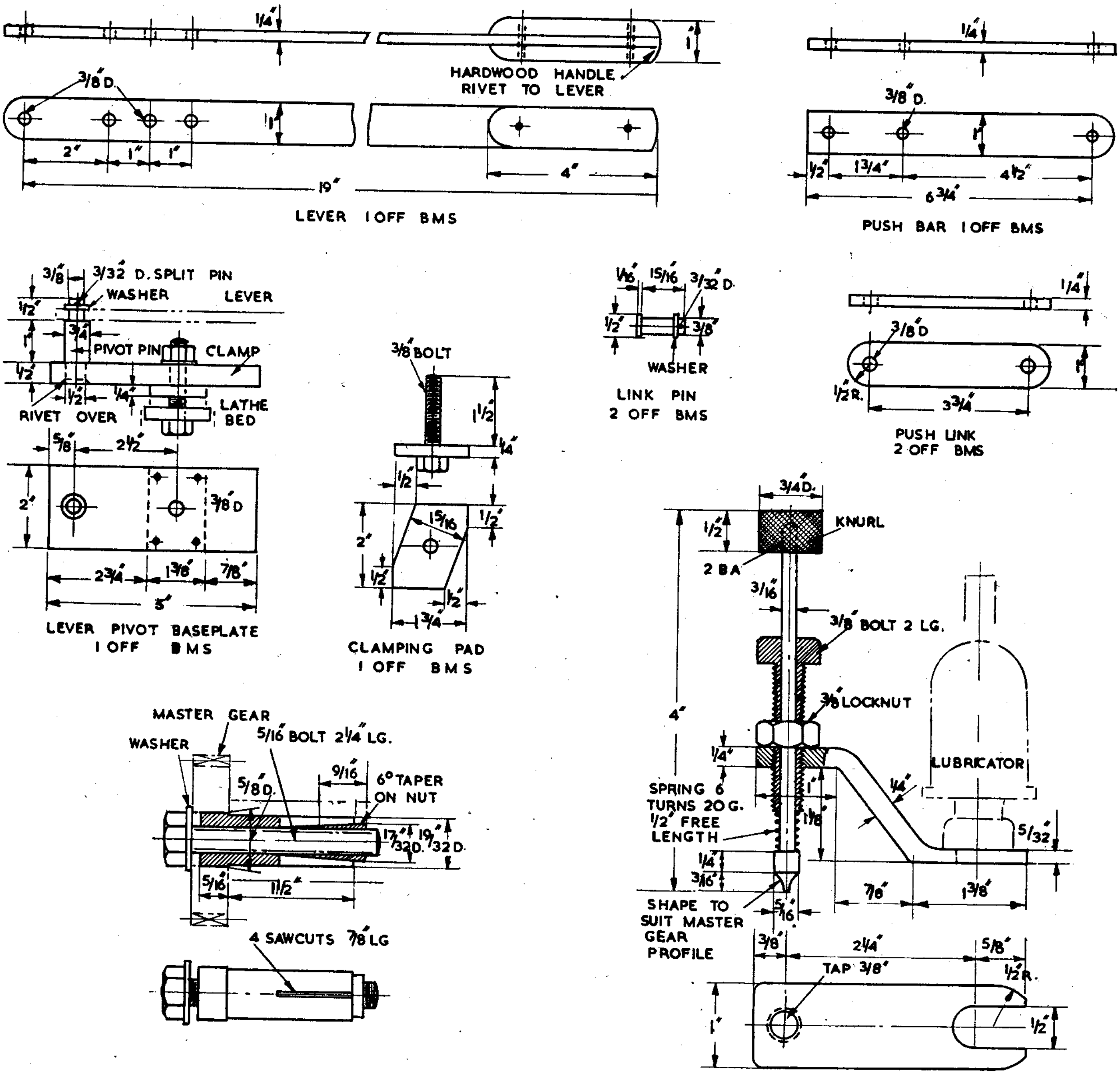
I drew some rough sketches of a planing attachment and dividing device and turned out the scrapbox to find some suitable pieces of metal. A length of 1 in. × $\frac{1}{4}$ in. flat bar provided a suitable handle. This I drilled to take the pivot pin and push link pins. The push rod was made of the same size material and drilled for bolting to the saddle; links were made from 1 in. × $\frac{3}{16}$ in. flat bar and drilled to take the connecting pins. A piece of 2 in. × $\frac{1}{2}$ in. flat bar provided a good clamping base for the planing attachment. Confronted with the possibility of long hours planing teeth, I riveted two pieces of hardwood on to the end of the handle and shaped them to form a comfortable hand grip.

To make the dividing device, I drilled a $\frac{3}{8}$ in. dia. bolt concentrically for the $\frac{3}{16}$ in. dia. spring-loaded plunger, mounting it on a piece of 1 in. × $\frac{1}{4}$ in. flat bar suitably bent and tapped. The bar was slotted at the end for fixing under the drip feed lubricator. I made a split collet type of mandrel for mounting the master gears on the rear end of the lathe spindle. The whole operation was completed in one week end. While the items were not a work of art, I considered them quite good enough to do the job.

The master gears proved to be a headache, as the standard change wheels of my ML7 did not cover the complete range of the gears I needed; 15, 20, 22, two off 26, 33, 50, and 100 teeth. The 15, 20 and 50 tooth wheels were taken care of by the ML7 change wheels, and as the 55 tooth change wheels gave 11 divisions I cut the 22 and 33 tooth wheels by first cutting 11 teeth in the blank and then rotating the blank one tooth pitch and cutting 11 more, and so on.

I also applied this method to the 100 tooth wheels, using the 50 tooth change wheel as master. This left only the 26 tooth wheel. No answer seemed to be forthcoming, and so I





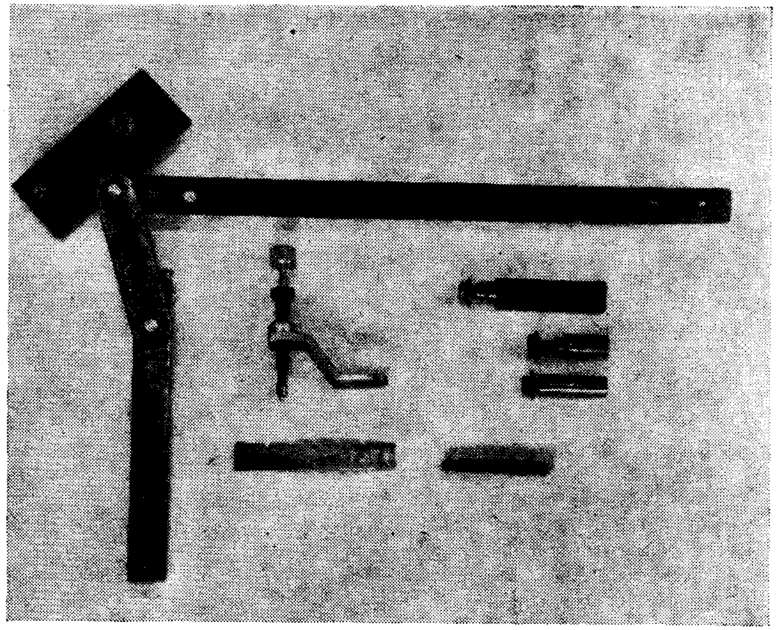
made a special divider by drilling as accurately as possible 3/32 in. dia. holes round the circumference of a brass disc. The disc was large enough to make small errors even smaller on the actual gear.

After this I came to the tooth profiles. As the gears had a diametrical pitch of 16, I constructed a complete set of profiles four times full size, on the drawing board. I made a gauge for grinding the form tools to shape, using dimensions taken from the profiles.

Having completed gear-cutting equipment, I began on the gear wheels themselves. The gear blanks were cut from $\frac{3}{8}$ in. thick mild steel plate and were annealed by leaving them in the living room fire overnight. I spent a weekend turning the blanks up. The 50 and 100 tooth wheels were turned and bored to finished size, but the remaining wheels were drilled $\frac{1}{2}$ in. dia. for mounting on a stub mandrel. As the 20 tooth wheel seemed to be a good one to practice on, I gripped the stub mandrel, with the blank mounted on it, in the three-jaw chuck. An old lathe tool was ground to the 20 tooth gauge profile and firmly secured in the toolpost at centre height. The dividing plunger height was adjusted to suit the master gear, locked in position with the plunger inserted in one of the teeth.

With the planing device firmly bolted down to both saddle and lathe bed, I cut the first tooth. A drop of cutting lubricant now and again helped enormously and the finished tooth profile was cleanly cut and bright. I pressed on with the remaining teeth, and about one hour later I finished the gear wheel. The result was better than I expected, but the time taken indicated that I would need plenty of elbow grease to complete the job. Cheered by my initial success, I cut the 22 tooth wheel, using the same tooth profile, reground the tool to the profile gauge, and cut the 26 tooth. By now, having had a good deal of practice, I succeeded in reducing the time taken from three minutes a tooth to about 2½ minutes. I cut the remaining gears, using the respective form tool profiles for each gear. After about 12 hours' work, all the teeth had been cut. This worked out at about 2½ minutes a tooth, including setting up, tool regrinds, and so forth.

I decided that the gears should be run together in their respective pairs with grinding paste to improve the accuracy of profile. A mandrel was made for fixing in the toolpost, the spigot being turned ½ in. dia. to suit the centre bore of the gears. One gear in the three-jaw chuck and one on the toolpost mandrel were run together in second backgear speed with a mixture of oil and grinding paste. A reversing switch is not fitted to my lathe, and so the gears were reversed and run again. This ironed out any small inaccuracies in gear profile that were present.



Components used in the planing of gears

After running all the gear pairs in this manner, I washed them in paraffin and again mounted them on the mandrels. After being carefully set to the actual running centre they were lightly oiled and run in second speed. No undue noise or chatter was heard when they were in mesh.

All that remained to be done was the boring out for pressing on their centres. The sight of eight shining new gears, made at no cost, more than justified the time and effort. ▣

HIELAN' LASSIE . . .

Continued from page 368

then turn up two little plugs for the cylinder ends as shown, from ¼ in. rod. They should be a tight drive fit in the bores; solder over the heads for the sake of safety. True up the port faces as you did the engine slide valves, and screw in the trunnions; these are 11/16 in. lengths of 3/32 in. round rod, screwed both ends, as shown in the illustrations.

The larger ram is a piece of ⅛ in. round silver steel, or rustless steel, ⅞ in. long, with a No 48 cross hole drilled at one end, and a flat filed on it to clear the big-end bush of the smaller ram. This is a piece of 3/32 in. steel, one end turned down to 5/64 in. and screwed 9 BA as shown in the little detail sketch. The bush is a ⅛ in., slice parted off a 7/32 in. rod held in the three-jaw. Drill a No 48 hole through the middle before parting off, and then drill a No 53 hole in the edge, and tap it 9 BA. The distance from end of ram to the hole is approximately 13/16 in. Pack the glands with graphited yarn, and round off the cylinders as shown in the plan view.

To make the bearing, chuck a piece of 5/16 in. hexagon brass rod in the three-jaw with 1 in. projecting. Turn down ⅞ in. length to 3/16 in. dia., and screw 3/16 in. × 40. Face, centre, and drill down 1 in. depth with No 41 drill. Part off 15/16 in. from the end, leaving a 1/16 in. head. Make a nut to suit, from the same size rod; face, centre, drill 5/32 in. for 3/16 in. depth, tap 3/16 in. × 40, chamfer the corners, and part off a ⅛ in. slice.

The spindle is a piece of 3/32 in. silver steel, approximately 1 1/16 in. long, with ⅛ in. of 3/32 in. or 7 BA thread on each end; it carries a ratchet wheel 7/16 in. dia., 3/32 in. wide, with about 35 to 40 teeth. The wheel should be drilled No 43 and forced on to the spindle, so that 1 1/16 in. projects from the bearing side. Tip for beginners: press an overlength bit of silver steel through the wheel first; then cut to length and screw the ends afterwards. This saves a lot of trouble, as you do not have to shift the wheel any more, when once it is on. Be careful that it is on the right way; with the long end of the spindle away from you, the vertical side of the teeth should point left, the sloping side right; the lubricator works clockwise, looking at the ratchet end.

The crank is only a few minutes' work. Chuck a bit of ⅜ in. round rod in three-jaw; face, centre, drill 3/16 in. deep with No 48 drill, and tap to match the spindle. Part off a ⅛ in. slice. At ⅛ in. from centre, drill and tap a 9 BA hole (53 drill) and screw in a piece of 15 gauge spoke wire, so that 5/16 in. projects from the crank disc.

★ *To be continued on October 6*

TAPER PRESS FITS

Model engineers can adapt a practice of heavy industry in the United States, says ROLAND V. HUTCHINSON of Michigan

MODEL parts are often assembled by press or shrink interference fits. When they are circular in shape, frequently as shafts and hubs, both are made cylindrical. But in the heavy machinery industry of the United States several manufacturers, over many years, have used taper press fits rather than straight ones. The tapers adopted are quite gentle, varying between 0.060 in. and 0.250 in. dia. per foot of axial length.

Despite disadvantages, the straight press fit persists largely because of the relative ease of mating parallel shafts and bores, but the shaft size is usually eased a little at entry to facilitate assembly.

Consider the differences in making the two kinds of fit. In the straight fit, it is customary to adopt a standard size of hole, perhaps reamed, and to control the tightness of fit by choice of excess diameter of shaft. The reamed holes have their own diametral variation, as new reamers are usually a little oversize, and so cut, while holes produced by them get smaller as the reamer dulls.

Commercially, reamers in US are made about thus:

Up to ¼ in. dia. are 0.0001-0.0004 in. oversize; over ¼ in. and up to 1 in. are 0.0001-0.0005 in. oversize; and over 1 in. to 2 in. are 0.0002-0.0006 in. oversize.

Problems of peening

By the time they cut about 0.0015 in. smaller than they did originally, they usually are "dull and done." While it is possible for the expert to peen the roots of teeth of reamers, say, ½ in. dia. and larger, to "grow" them perhaps 0.003 in. to 0.005 in. to enable size to be restored by a very careful regrind, the undertaking is hazardous, for the teeth may be broken very easily during peening.

On the other hand, in mating taper press-fits it is usual to hold the big-end diameter of the shaft taper to close uniformity of size, and to vary the fit by controlling the depth to which a tapered reamer is sunk in the hole.

The "stickout," either of a gauge or of the shaft used as a gauge, in conjunction with the conicity, is a measure of the interference between the shaft and the hub attained when the parts are pressed together until the big ends of their tapers coincide.

Taper pin reamers producing a series of overlapping holes tapered ¼ in. dia. per foot are sold as standard. So-called "tapered" hand reamers are also obtainable from time to time, as Ministry of Supply surplus. A leading Sheffield maker of small tools told me that he believed these "tapered" hand reamers, of carbon steel, were intended for general use in mobile Army repair shops, and were intended to remove much more material than is ordinarily handled by a "parallel" hand reamer. While he thought that the customary tapers were about 1/16 in. per ft on dia., he did

REAMERS FOR TAPER PRESS FITS

Nominal Size	Kind	Make	Big End Dia.	Taper/ft. (Measured)	Flute Length	Stickout per 0.001 Interf. (dia.)	Cone Angle with Axis (Range of X)
17/64	Taper Hand	B.S.A.	0.2662	0.1122	2	0.1069	
19/64	„ „	Easterbrook	0.297	0.102	2 1/16	0.1176	
5/16	„ „	B.S.A.	0.313	0.1115	2	0.1076	
21/64	„ „	Millersburg*	0.3285	0.1167	2 3/8	0.1028	0° 16′ 43″ max.
3/8	„ „	Easterbrook	0.3755	0.1032	2 17/32	0.1163	
7/16	„ „	Niel	0.4375	0.0985	2 7/16	0.1218	
15/32	„ „	Webb	0.469	0.096	3 1/32	0.125	0° 13′ 45″ min.
31/64	„ „	B.S.A.	0.485	0.1144	3	0.1049	
17/32	„ „	Hall	0.531	0.100	3 1/16	0.120	0° 14′ 20″ nom.
11/16	„ „	Lynn	0.6865	0.1567	3 1/2	0.0766	0° 22′ 27″
No 8	Taper Pin	Pickford	0.5115	0.251	6 9/16	0.0478	
No 7	„ „	Morse*	0.4235	0.2506	4 1/2	0.0479	
No 7	„ „	Balfour	0.418	0.255	5 1/8	0.0471	0° 36′ 31″ max.
No 6	„ „	National*	0.353	0.2502	3 9/16	0.0480—	
3/8	„ „	Unknown	0.3875	0.253	5 1/32	0.0474	
11/32	„ „	Dormer	0.352	0.253	4 3/8	0.0474	
No 5	„ „	Morse*	0.302	0.250	3 1/32	0.0480	0° 35′ 48″ nom.
5/16	„ „	Easterbrook	0.322	0.252	3 7/8	0.0476	
No 4	„ „	Morse*	0.258	0.248	2 1/2	0.0484	0° 35′ 31″ min.
	* American Products.						

not cite any dimensional standard to which they were supposed to conform.

Apparently their function was to make possible a somewhat smoother, and perhaps more accurately-sized short hole, than a merely drilled one (provided that it were reamed from both ends) more easily and better than by opening them up by filing. I own a number of such reamers, none of which happens to be tapered $\frac{1}{16}$ in. per foot, although several of them approximate 1/10 in. For their original purpose exact and uniform tapers must have been non-essential, so there seems no guarantee of similar tapers occurring on "taper" hand reamers of a given nominal size, even of the same make, although it is likely that a given maker will adopt some reasonably uniform taper for his own product. If such tools are expected to be used for taper fitting purposes, it is strongly urged that they should be identified and measured, and that their dimensions should be recorded.

My record of "taper" hand reamers is reproduced as Table I, a copy of which is tacked up on my shop wall. Besides the reamer dimensions, note the "Stickout per 0.001 in. interference" and the range of angles of taper with the axis. In reworking parallel reamers to tapered ones for press fit use, a taper of 0.060 in. dia. per foot is strongly advised; the stickout per 0.001 in. dia. interference is 0.200 in., a simple number to remember.

Stresses in parts thus connected are about the same as for straight shrink fits; interference allowances on diameters are about the same for equivalent security. In large machinery, where spoilage cannot be risked, the taper press fit has proved itself over the years. It affords a safeguard during machining and security after assembly; and these are also the requirements of the model engineer.

An excellent numerical treatment of the inter-relationship of sizes, interferences and stresses in force fits, made with similar and dis-similar materials, is given in Chapter XI of Morley's *Strength of Materials* (Longmans).

THE TWO STEPHENSONS

FOR YOUR BOOKSHELF

George and Robert Stephenson, *by L. T. C. Rott. (Longmans)* 30*s.*

GEORGE STEPHENSON was undoubtedly one of the world's greatest engineers. In Mr Rott's new book, the author explains why George is so much better known than his son Robert, who was an equally brilliant engineer, though much more modest and retiring by nature.

In fact in many ways the most interesting aspect of this dual biography is the extraordinary contrast presented between the father and the son.

Many people today still labour under the impression that George Stephenson *invented* the steam locomotive. As Mr Rott clearly shows, this was not so, and even in the development of the locomotive, it was Robert who made the bigger contribution.

George, however, certainly did more than anyone to introduce both the steam locomotive and the railway itself to the world. A brilliant practical engineer, he relied on his son to fill the gap in his own technical and theoretical education.

In this most interesting book, Mr Rott tells once again, with great accuracy and in vivid detail, the stories of the safety lamp, the building of the Stockton and Darlington and Liverpool and Manchester railways, the Sammons locomotive trials at Rainhill, the building of the Conway and Britannia bridges and many other great works of engineering which launched the Industrial Revolution.—R.M.E.

MY SIMPLE OIL PUMP

By H. F. KIRBY

WHEN I had built my $3\frac{1}{2}$ in. gauge *Britannia* to the point of running under steam I ran into a lubrication problem; the ratchet lubricator would not work consistently.

A club colleague suggested that I should make a pump which he had designed. I found it to be highly efficient.

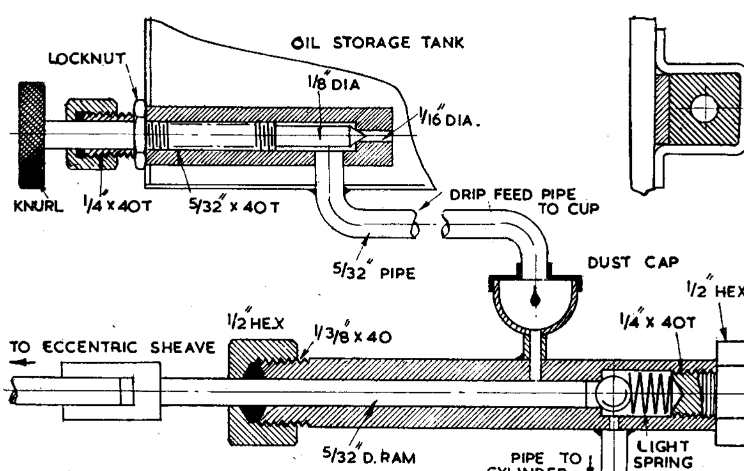
The pump is of simple construction. The only point where extreme care is needed is in the drilling of the bore. This was the method I used. Grip a piece of bronze, $\frac{3}{8}$ in. square × $2\frac{1}{4}$ in. long, in the four-jaw and with a $\frac{1}{8}$ in. drill bore to a depth of 1 in., withdrawing frequently to clear the swarf. Follow this with a No 24, which is four thou under 5/32 in. to a depth of $\frac{7}{8}$ in. Follow through with the $\frac{1}{8}$ in. drill another $\frac{7}{8}$ in. and enlarge with the No 24 right through. Next, drill to $1\frac{1}{8}$ in. with a No 22, leaving the remainder to be hand-reamed 5/32 in.

The position of the cup depends on the stroke of the eccentric which drives the ram. The cup hole should be just uncovered when the ram is at the end of the backward stroke.

In operation, a vacuum is caused on the backward stroke, and what oil is in the cup is instantly drawn in when the cup hole is uncovered.

Two clips secured the pump to the inside of the main frame. I also found it expedient to solder one clip to the pump body which helped me, in the limited space, to mark off the holes. The soldered clip kept the pump secure when in action.

There is one important point in operating this type of pump. Do not forget at the end of the day's run to shut the needle valve.



READERS' QUERIES

This free advice service is open to all readers. Queries must be of a practical nature on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling cannot be given: stamped addressed envelope with each query. Mark envelope clearly "Query," Model Engineer, 19-20 Noel Street, London W1.

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

Vibrator fretsaw

I am hoping to build a jig or fretsaw on vibrator lines with the solenoid held in the hand with the blade extending after the fashion of a keyhole saw and also to be fitted in a U-frame for use as a fretsaw. I would rather be overpowered than under. Can you give me some idea of the windings and core, please ?—E.R., Warter.

▲ *The use of a solenoid for your proposed saw is impracticable. It would call for a special design which would be beyond the facilities of a query reply. Tools of this nature are operated on alternating current by the use of a vibrating reed. Hair clippers, massage machines and similar apparatus work on this principle.*

There is a fretsaw operated in this way on the market. If you can provide a sketch giving the proposed overall size of the saw unit you want to make, help could be given as to a core and winding.

This core would be the same shape as a small transformer core, the stampings being of the U-section, with the coil wound on one limb only. The reed vibrates against this in the same manner as a bell hammer. The stroke of the reed is very limited, and could not give a sawing action over a length of stroke.

Metal for castings

In the trade in which I am employed we use bronze or gunmetal for castings of, nominally 85/5/5/5 per cent copper/tin/zinc/lead alloy. We also use sheet bronze metal of approximately 85/15 per cent to 90/10 per cent copper/zinc content, known in the trade, I believe, as "gilding metal."

As I can obtain, fairly cheaply, castings and offcuts respectively of these metals, would you kindly advise me as to whether they are suitable for the usual model engineering applications, i.e. cylinder, steam chest, bearing castings, etc., and boiler plates ?

Should you consider them unsuitable, would it be troubling you too much to give me briefly, the reasons why ?—H.G.I., Birmingham.

▲ *The gunmetal composition* 85/5/5/5 *per cent—copper, tin, zinc, lead alloy, is satisfactory for such castings as cylinders, steam chests, horns, etc., although for axleboxes and other bearings the more common* 89-90 *per cent copper,* 10 *per cent tin, is to be preferred.*

Regarding the sheets of composition 85 *per cent copper,* 15 *per cent zinc or* 90 *per cent copper,* 10 *per cent zinc, these are really brazing brasses, and have too much copper for model engineering purposes. This gives it high conductivity and ductility, but very low tensile strength. These sheets could not be used for boiler work, owing to the presence of a considerable proportion of zinc.*

Boring a true hole

Can you suggest a supplier of aluminium alloy telescope tubing suitable for making a camera tripod ?

In E. T. Westbury's book *Milling in the Lathe* the construction of a small milling spindle is described. A piece of square section steel is bored and bushed and a silver steel spindle inserted.

I wish to know how a 2½ in. long square section can be accurately bored so that on fitting the bushes, the spindle runs dead true without binding. I cannot use a boring bar since my spindle is only ⅜ in. dia. with the outside diameter of the bushes about ⅝ in. I did bore out one piece by a straight drilling operation and obtained a good result but I feel this was pure luck and would appreciate advice on how the job should have been tackled.—K.E.L., Blackheath.

▲ *It is presumed that you mean tubing in a range of different sizes which will telescope one into the other. One or other of the following firms may be able to supply you: T. W. Senier Ltd,* 115/121 *St John Street, Clerkenwell, London, EC*1, *or H. Rollet and Co. Ltd,* 6 *Chesham Place, London SW*1.

With reference to your difficulty in boring a true hole of ⅝ in. dia. through a piece of square steel 2½ in. long, this should be a perfectly straightforward operation.

If the hole is started with a centre drill and followed up with an undersized drill, with reasonable precautions to ensure that in each case the drills are starting truly, it should be quite an easy matter to finish the hole by means of a single-point boring tool of suitable size and length. The shank of the tool should be as large and rigid as can comfortably be used. If a sufficiently high finish cannot be obtained with the boring tool, the hole can be finished with a reamer, floating cutter, or D-bit.

The result you describe is not just a matter of luck, as it should be possible to obtain certain results every time by reasonable care.

Building a loco

I have served a mechanical engineering apprenticeship and can use bench and machine tools with reasonable competence. How many hours might I expect to take in constructing the 5 in. gauge 4-6-0 *Springbok* ?

Would a lathe such as the Tyzack Zyto 3⅜ in. × 12½ in. be large enough for all machining operations on the 5 in. gauge 4-6-2 *Britannia* or the 4-6-0 *Springbok* ?

There are two Zyto lathes, the larger being 16 in. between centres and costing £7 more than the 12½ in. model. Assuming that the 12½ in. lathe is adequate, is there any aspect of model engineering that would make the acquisition of the 16 in. model desirable, or would the £7 be better spent on other tools and equipment ?

Again assuming that the Zyto 3⅜ in. × 12½ in. is adequate, can you recommend any other make of smaller and cheaper BGSC lathe which would still be adequate ?

You will note that I propose to build a fairly complex engine as a first model on the assumption that in terms of skill and diversity of constructional work, there is no basic difference between building, say, a 0-4-0 in 5 in. gauge and a 4-6-2 in 5 in. gauge. The difference lies in the much greater repetition of work in the latter design and the greater expenditure of time and patience. Do you agree ?

What book gives descriptions, history, drawings or photographs of British locomotives ? I would for instance like to read something of the history of the 4-6-0 *Springbok* type and also see samples of the types of locomotives which are mentioned in your catalogue of working drawings.

Is it your opinion that plate-glass can be adapted satisfactorily for use as a surface plate in model engineering ?—J.M.Y., Knutsford.

▲ *About 1,500 hours would be needed to build a 5 in. gauge locomotive of medium size, although if full detail is required this might take 500 to 1,000 hours more.*

While the Zyto lathe would do the job, something a little heavier is advisable.

You will find a 5 in. gauge BRITANNIA *rather a difficult model for a first attempt. On the other hand, the 4-6-0* SPRINGBOK, *though fairly large, is a very straightforward design. A Pacific (especially* BRITANNIA) *is more difficult to build than a 0-4-0T.*

With regard to books on full size locomotives, Steam Locomotives, *by O. S. Nock (George Allen and Unwin) and* Modern Railways, *by Cecil J. Allen (Ian Allan and Co.) are recommended.*

Plate-glass should be sufficiently accurate for your purpose.

Apple-press

What is the latest method used to replace the old apple-press for making cider? Drawings and particulars would oblige.—E.W., Linthwaite.

▲ *The old type of apple-press is still used in Devon and Somerset, at least on the farms, but no doubt modern methods of manufacture have been introduced for large scale production and possibly new machines have been developed.*

Routing by power

I am engaged in building two 36 in. model yachts and find the gouging work pretty severe. I would like, if possible, to have further details of the method of routing by power, referred to in MODEL ENGINEER.

I have tried some wood cutting routers with an ordinary electric hand-drill, but this is quite useless, as the speed is not nearly high enough at 3,000 revs. Furthermore, it is impossible to hold a hand-drill firmly enough, no matter how securely the work-piece is held.—T.C., Cork.

▲ *It would be very difficult to use routing tools with an ordinary hand-drill as, apart from the matter of speed, it is most essential that either the spindle or the work should be rigidly held.*

In the case referred to, a small sensitive drilling machine was used, but one of the popular types of electric power tools, mounted on a suitable stand, could be adapted to the purpose. It would even be possible, by fitting the chuck to a small high speed electric motor and clamping this to a suitable support, to operate the rotating tool quite satisfactorily.

The term router may need some further explanation, as the ordinary router used in wood-working machinery is generally made with only one or two cutting edges. Although this cuts very efficiently, it may be found difficult to control. The type of rotary cutter known as a rotary file is better in this respect, but the type having relatively coarse teeth will be found most efficient for the particular operation.

Fly cutters

A casting in brass has to have two slots and some outside faces machined and it is desired to do this at one setting in order to ensure that all surfaces are parallel. It is proposed to make a form of boring bar to take a $\frac{5}{16}$ in. × $\frac{5}{16}$ in. cutter secured by a $\frac{1}{4}$ in. Whitworth grubscrew. The maximum cutter entrench would be $1\frac{1}{2}$ in. It is proposed to run the bar between centres and reverse it end for end for machining the second slot, in order to avoid such springing as might occur with a cutter mounted centrally in a longer bar. The maximum diameter possible to clear the casting when mounted on the slide table is $\frac{7}{8}$ in. Will this method be satisfactory?—L.C.R., Glasgow.

▲ *It is quite practicable to use a fly cutter for the type of operation suggested. You do not make it clear as to whether the surface at the base of the slot is also to be machined. If so, this would call for some means of adjusting the castings transversely relative to the cutter axis, and there might be difficulty in obtaining a smooth cut with a tool having a wide front edge.*

It would be better to use either separate right and left-handed side tools for working on the two sides of the slot, or, if one tool only is used, it should have not only cutting clearance on the sides but also back clearance to reduce the length of surface in contact with the work when at full depth.

The use of fly cutters is dealt with in some detail in our handbook Lathe Accessories.

Silver steel

I would like to ask a question on the cutting of screw threads on silver steel. The problem arose in this way. My brother asked a blacksmith to thread a piece of $\frac{1}{2}$ in. stainless steel for him. The blacksmith broke his die and, I understand, made caustic remarks about the hardness of the steel. It was, however, soft silver steel as purchased.

Some time later I found that Gordon, in *Clockmaking Past and Present*, warns against using screwing tackle on silver steel which he says even in the soft state is distinctly detrimental owing to its hardness.

On the other hand, in genera turning and filing I do not find silver steel particularly hard to work. It would be extremely convenient for many small screws which I like to harden but I am naturally hesitant about using expensive screwing dies upon it. I would be very glad to have your opinion.—T.D.F., Belfast.

▲ *Stainless steel is sometimes rather difficult for screwcutting, particularly if the tools are not perfectly sharp, as it is liable to harden up and glaze under the burnishing action of the tool. Silver steel may possibly behave in a somewhat similar manner, even though thoroughly annealed, but, generally speaking, the essential thing is to use keen and properly-set tools in both cases. The use of silver steel is not advised for threaded parts, as it is rather short in the grain, no matter what form of heat treatment is used.*

There are several forms of carbon or alloy steels, which are more suitable for making high tensile screws. The most readily obtainable is a three per cent nickel steel or low nickel chrome steel, machined and left in the untreated condition as supplied by the manufacturers.

Buying a lathe

I would like to know if the Flexispeed 2 × 8 model A lathe would be large enough to tackle such things as traction engines and stationary steam engines—particularly a Stuart No 10V engine to begin with; or do you consider the Bormilathe would be of more use to me?—P.T., Ventnor.

▲ *It should be possible for you to tackle a traction engine, stationary engine and a Stuart No 10 with either the Flexispeed or the Bormilathe. The maximum size traction engine permissible on either of these would be a $1\frac{1}{2}$ in. scale.*

Divider scales

I have come into possession of a pair of proportional dividers and I am puzzled about the graduations on each side of the long slot. One side says: "Lines, starting at 10 and finishing at $\frac{3}{4}$," the other says: "Circles starting at 20 and ending at 6." I should be glad if you could give some idea how to use the instrument.—J.W.S.—Bacup, Lancashire.

▲ *The graduations on proportional dividers are often marked with as many as four different scales. The two scales to which you refer are presumably*: (1) *linear scale and* (2) *scale of areas of circles. Other scales sometimes provided deal with the proportions of squares and cubes.*

POSTBAG

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

BALDERED ASH

SIR,—May I add the following comments to a most interesting discussion on mush-thraxing? With all due respect to your correspondents, I would like to draw attention to the methods now used in Scandinavia, where pedal-operation is a thing of the past. Mr Galaway's proposed improvement has a highly scientific basis, but I venture to suggest that quite a high percentage of mush might still remain unthraxed and leave the plant as unusable endmush. Also, owing to incomplete enclosure, risk of occupational diseases such as "the lurch" and "thraxer's thumb" would be considerable.

Norwegian brains have mastered the problem of safe and profitable thraxing. At the Guttakandel works in Flammensmoekivik the mush is thraxed in large spherical "stabilisers"; in these, charges of mush are subjected to pressure by an inert gas in the presence of a catalyst, the substance used being cheap and abundant. It is ordinary furnace ash, and after the gas has passed through it the ash is said to be "baldered." (A root in Scandinavian mythology, perhaps?)

Jargon was the gas first used; later, a much cheaper substitute was found in asinane, a by-product of Westminster Gasworks. Asinane was at first thought to be of no industrial value and was allowed to escape through the gas-house ventilators and up the well-known clock-tower, but a method was discovered of rendering it non-flammable by the extraction of impurities such as nicohol and alcatine. The pure gas, as might be expected in view of its origin, is utterly inert. In its unrefined state a stray spark of intelligence has been known to ignite it, when a recumbent flicker could sometimes be seen around the back-benches of the retort-house, usually when the caustic-retorts were not in operation.

After being "scrubbed" by passing through National-type presses (the rubbish or "scoop" remaining as an oily black deposit on the filter paper) the gas is stored in ceramic containers, known to the men who handle them as "stone bonkers," and exported to Norway. It is a far cry from the bad old days, when inhuman mush-masters compelled ailing workers to "trudge" out the raw mush until "trudger's lurch" annulled their usefulness, to the modern installation in which no hand touches the product until it leaves the electronic mushmeter in sealed drums. All this may seem to have little to do with model engineering, yet a miniature up-to-date mush-refinery would make an interesting exhibit.

Great credit is due to Mr Padfield for playing down, for the sake of public tranquillity, the alarming incident at the Goole Mush-Festival. Fortunately there were no serious casualties, but I have it on good authority that Jodrell Bank is still tracking the Mayor's hat and chain.

With sincere good wishes to MODEL ENGINEER.

Bourne End, Buckinghamshire. W. HARRISON.

BRONX BOUQUET

SIR,—I would like to take this opportunity to congratulate you on the excellence of your publication. The only improvement I can presently think of would be the use of a better quality of paper as the paper now used tends to yellow with age.

I hope that in the near future you will see fit to run a series of articles on the construction of single and multiple rotor steam driven turbines, and suitable boilers to drive them. I would particularly like to see a prototype of the turbines used to propel the larger merchant and naval vessels. I understand that you published some information on the subject several years ago, but since my file of copies of MODEL ENGINEER only goes back to 1 September 1955, and back copies are not available in the libraries here, this information is not accessible to me. If nothing new has been done recently in this field perhaps you might consider republishing the older material, including basic design points so that one might carry on from there.

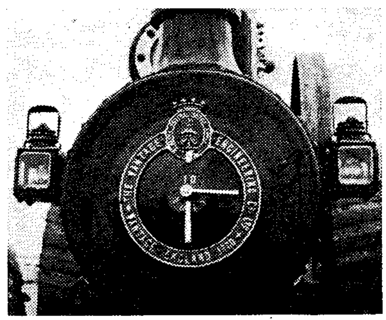
With best wishes for your continued success.

Bronx 68, New York. FRANCIS W. SEE.

We would like nothing better than to see ME printed on a better paper but the cost of using the next grade would be phenomenal and would mean an increase in the price of the magazine.—EDITOR.

MORE LIGHT

SIR,—Herewith please find a photograph of the smokebox of the *Wantage*, single cylinder traction engine No 1389 (Reg. No PB9722) taken at the rally at Mount Hawke, Cornwall on July 16. The picture shows the inscription which was the subject of some correspondence in Postbag some months ago, and also shows the fine pair of headlamps.



"Astra castra lumen numen," *reads the inscription on the Wantage engine at a rally in Mount Hawke, Cornwall*

Photographers at these events should take care of the lens. I had puzzled why some of my pictures were not so good, and on closely examining my lens I found minute spots of oil covering it, evidently thrown from the motionwork of the engines, I now take the precaution of fitting a filter that is easily cleaned; I also carry a small bottle of cleaning fluid.

Bideford, Devon. J. DAVIES.

SENTINEL

SIR,—Many of your readers must be puzzled by the Sentinel in the photograph sent by Mr S. R. Bostel [Postbag, August 18] as only about a hundred of these engines were built. They were three tonners with the boiler in the same position as in the S type but the bunker right in front. The little engine had two cylinders $6\frac{3}{4}$ in. dia. × 6 in. stroke and the pistons were interchangeable with those used on the larger models then building (1909).

During my 38 years as Liverpool Service Depot manager I had quite a number in for repairs and found them delightful to handle, they were quick off the mark, with a full head of steam and could out-distance any three ton petrol vehicle of the period.

I kept one as a breakdown vehicle during the first world war and used it for collecting spares from the works at Shrewsbury. It was pariffin fired, but shortly after acquiring it from Liverpool Fire Brigade, which had used it as a hose tender for many years, I converted it to coal burning.

Liverpool. JAMES STOTT.

JUST LIKE IT!

SIR,—The photograph sent to you by G. W. Jackson [ME, August 18] looks to me like a single cylinder portable made by Messrs Ransomes Simms and Jefferies in Ipswich about 1918.

As a boy, I spent many happy hours tending one of these while it was driving a threshing drum or a chaff cutter on a farm in Cambridgeshire.

I enclose a photograph which I took in May 1957 at a rally in Hannington, Northants, of just such an engine.

This particular one, No 20737, was in fine condition and was turning over noiselessly on a very low pressure of steam.

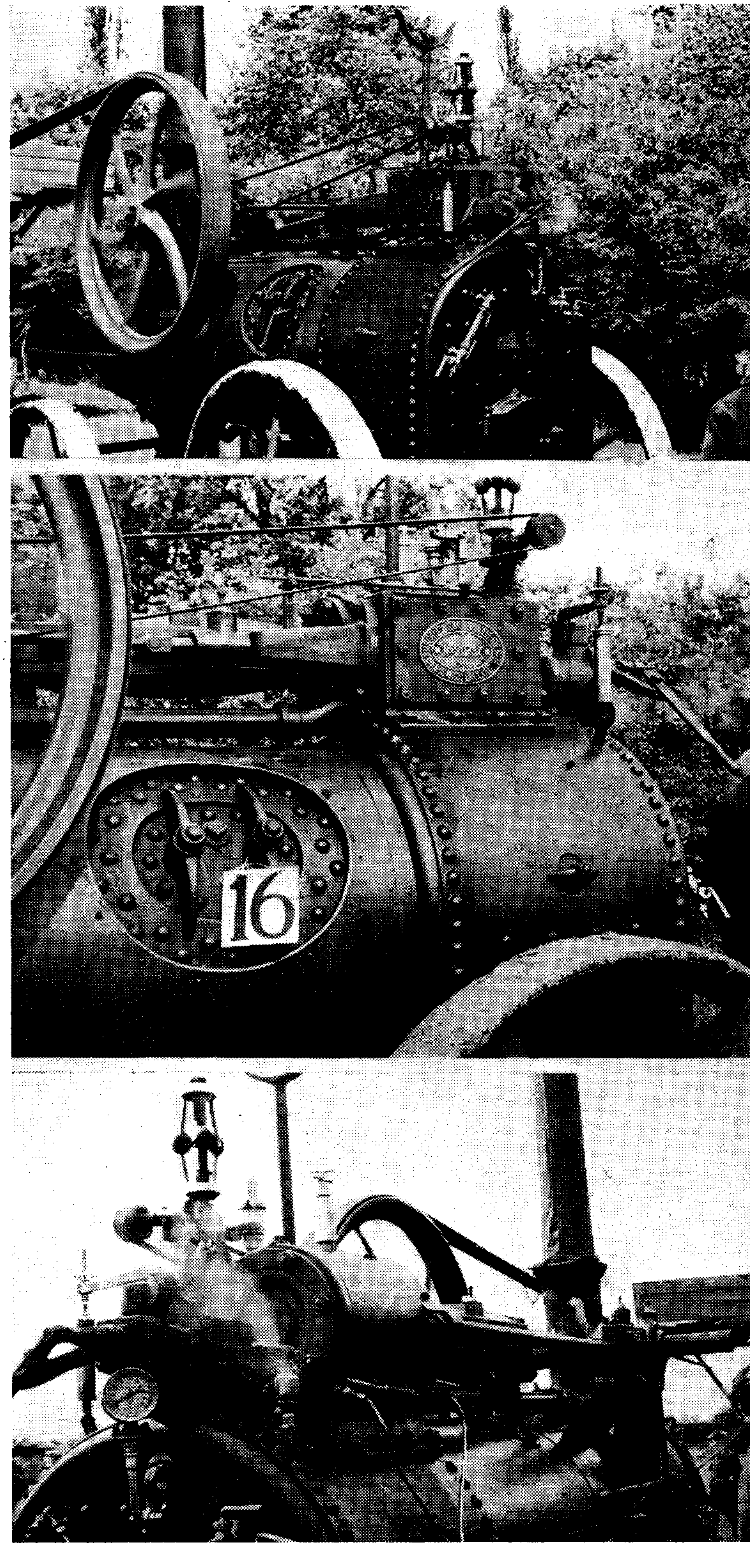
Letchworth, Hertfordshire. A. B. POOLEY.

FOWLERS IN GERMANY

SIR,—A few notes on the letter and pictures about Fowlers in Germany [Postbag, July 28] may be of interest.

John Fowler and Co. sent a set of ploughing tackle to Germany in 1868, and the following year Max Eyth, later the founder of the German Agricultural Society, took over for the purpose of demonstration a pair of 14 h.p. horizontal shaft double-cylinder engines. So successful was he that in a few years the firm set up a branch at Magdeburg which until 1914 handled a very large share of the ploughing tackle output. At one period almost the entire production of the steam plough works was going to this branch. After the war Wolf took over the business and advertised "to Fowler's designs."

Other German firms to build P.Es. were Heucke, Borsig, Lanz, and Rhein Metall, while Kemna challenged the compound engine with highly superheated double-cylinder types. Kemna adopted the Schmidt superheater in the fire tubes; to meet them, Fowler were obliged to have recourse



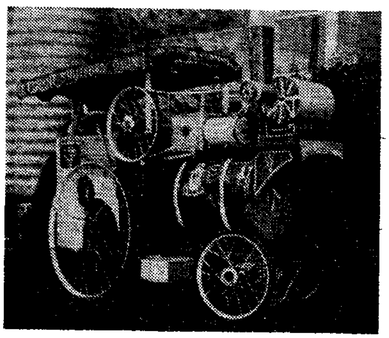
In Northamptonshire A. B. Pooley saw "just such an engine" as the one shown in an old print found by a Bedfordshire reader to superheaters in the smokebox, or they would have infringed patent rights. Although in trials the English superheated compound beat the Kemna engines, in this country at any rate the superheater speedily found a resting place in the scrapyard.

Of the engines listed in the letter, 14195-6 are BBS, 13499-500 ZAS, 13316 K7, and 12350 ZAS. I cannot trace 10280. All these engines except 13316 are fitted with superheaters. Note in the photograph the cleats for attaching widening rings in the hind wheel.

Tacolneston, (REVD.) R. C. STEBBING.
Norwich.

ANY MORE ?

SIR,—The photograph which I am sending you is of my model showman's engine with a half-canopy and dynamo. It is a non-working model



" Has any other reader one like this ?" asks a correspondent

and was made out of pieces of scrap. It took me a month to make in October 1959.

I should like to know if anyone else has made one like it ? I have read MODEL ENGINEER since 1949 and I enjoy any traction engine news.

Shutford, TONY T. GRANT.
Oxfordshire.

BOLTED BLOCKS

SIR,—I would like to confirm F. D. Woodall's statement [Postbag, July 7] on the securing of traction engine cylinder blocks by bolts. Often in full-size practice the manufacturer made a small hand hole in the top of the front tube plate so that the erector could push the bolts through. This was so in all Tasker's engines, and when the tube plate became thin we often had to weld the hand hole up as they were very prone to leak badly.

When I was engaged in traction engine repair work we used a long iron rod with a clip end into which the head of the bolt was fitted. The rod and bolt were then put through the manhole fitted in the side of the barrel. The bolt was pushed through its hole, and the mate would then screw on the nut, after which a tug on the rod would release the clip from the bolt head. It was not, of course, possible to get inside the boiler when it was fully tubed up. It may help Mr H. H. Nicholls [Postbag, July 7] to know that Wigzell and Halsey eventually became Pollit & Wigzell. There is a beautiful example of one of their tandem compound Corliss mill engines in the Birmingham Museum of Science and Industry.

Chippenham, M. SPEAREY.
Wiltshire.

TIMING GEARS

SIR,—In MODEL ENGINEER of August 4 you answered a query from D.R.C. of Bristol on skew gears for a 10 c.c. o.h.v. petrol engine.

The details correspond to an engine I designed in 1941. If, in fact, it is the same, then I should be pleased to assist D.R.C. with any queries.

My engine was air-cooled, had an overhung crank, and was intended for model aircraft. Incidentally, engine and aircraft are still with me and occasionally get airborne.

Bournemouth, D. E. PARKER.
Hampshire.

P.S. It would be rather a coincidence if D.R.C.'s engine is my design, as this particular ME was bought by my son and was the first copy I had read since being called-up in 1943.

COVER PICTURES

SIR,—I am the owner of over 650 issues of MODEL ENGINEER and I find much pleasure in re-reading them for changing interests in new fields of hobby pastime.

The very evident good judgment of your staff in the selection of cover subjects should not miss the appreciation of your subscribers. I should like to offer a vote for one favourite cover that always calls for study, over and over—the one of 20 October 1955.

Here, we have two handsome children absorbed in the mystery of something new to them. Nothing—but nothing—is more captivating than the undivided, completely honest and wondering interest of a little child.

MODEL ENGINEER, in retrospect, yields many cover subjects which show exceptional attention value, well worthy of reader study.

Wooster, Ohio. ROBERT T. EBERT.

HITLER'S SWASTIKA

SIR,—May I be allowed to find technical fault with the seemingly excellent model of the battleship *Gneisenau*, which H. R. Wilson described in ME of July 21 ?

The forward " upstairs " 11 in. gun turret is shown marked with a " left-handed " swastika. This is incorrect. The Greeks, or perhaps the Romans, used the left-hand swastika as a sign of peace. Hitler turned the swastika about to comply with his own ideas.

If Mr Wilson is not to blame for this mistake—he is correct in the stern drawing—could the fault possibly be in the printing process of the ME ?

Bromley, DAVID M. WELLS.
Kent.

I assume Mr Wells is referring to what is known as " reversal." This, for obvious reasons, is never used in MODEL ENGINEER. *The reproductions in Mr Wilson's article were not touched or altered in any way. Perhaps Mr Wilson can solve the riddle of the swastika.*—EDITOR.

CANBERRA . . .

Continued from page 363

Two-sheet is useful for overlays; four-sheet would do nicely for the decks of the larger model and three-sheet for the smaller one. The thickness of the decks may be a little over-scale, but if they were of correct scale thickness they would be liable to buckle where they overhang the cabins. To maintain the correct height from deck to deck the cabins may have to be reduced slightly in height.

The heights from deck to deck, as given on the builder's drawings, are: Promenade Deck to B Deck 11 ft, B Deck to A 8 ft 6 in., A Deck to Arena Deck 8 ft 6 in., Arena Deck to Games Deck 10 ft, and Games Deck to Officers' Deck 8 ft 6 in. The dimensions must be adhered to strictly, as the cumulative effect of errors here can spoil the proportions of the whole ship.

The deck houses may be made of any good, fine-grained wood, and should be planed accurately to the thickness needed to give the correct heights from deck to deck. As there will be an overlay of two-sheet Bristol board on each side where the house comes to the side of the ship, the width should be such that with the two overlays it will be exactly equal to the width of the hull. A slight rebate will be required on each side of the hull along the promenade deck aft of Station 17, but particulars of these will be given at a later date in discussing the overlays.

★ *To be continued on October 6*

CLUB NEWS

Send news and notices to The CLUBMAN, 19-20 Noel Street, London, W1.

EXETER SEARCH

THE premises of the Exeter and District MES have for some time been gradually getting worse. At last the inevitable has happened: the buildings have become so bad that the owners have advised the society to vacate them at the earliest possible moment. This means that very shortly this go-ahead society will be homeless.

Now, the task of searching a city as large as that of Exeter for suitable premises is an arduous one, and I am sure that the secretary would appreciate hearing of any building which might serve.

Luckily, things are not quite so bad as they might have been. A friend of the society has kindly offered to store the equipment, boiler and O gauge layout until the society can once again use them. The society has not died; now that the clubroom is no more, the members will be meeting at their track at the Orthopeadic Hospital.

Recently a number of members paid a visit to Mr M. Densham's 10¼ in. gauge gtrack at North Tawton, where they were treated to a demonstration of Mr Densham's new petrol-electric locomotive.

Secretary: Mr H. G. Angel, The Forge, Longdown, Devonshire.

FILMS AT ELTHAM

At the next meeting of the Eltham and District Locomotive Society—in the Beehive Hotel, Eltham on Thursday, October 6 at 7.30 p.m.—the treasurer, Mr Stan Brock will show films of recent runs on the North London SMEE track at Arkley and on the Sussex Miniature Locomotive Society track at Beechurst.

At the last meeting, after a series of lengthy discussions, it was decided to buy the steel and begin construction of the new type of semi-portable track designed by Mr Jim Ewins, vice-chairman of the society.

Secretary: Mr F. H. Bradford, 19 South Park Crescent, London SE6.

HITCHIN GUESTS

After a strenuous season of public engagements at home and away, the members of the Hitchin and District MEC had a day's pleasurable relaxation when they invited model engineers from Cambridge, Brentwood and Hatfield societies to an afternoon's running on their track. The visitors brought along a varied selection of locomotives ranging from a beautiful *Tich* to a 5 in. gauge streamlined Pacific.

Mr Hyman of the Cambridge MES demonstrated the ready availability of diesel locomotives by lapping the course several times with his 0-4-0 petrol-driven shunting engine before any of the steam-minded visitors could get their fires going !

The Hitchin club paid a return visit to the Cambridge Society and spent most of the afternoon on the Cambridge Society track. The new steaming bays and the connection to the main line were much admired and not a little envied.

Secretary: Mr E. Coleby, 21 Walsworth Road, Hitchin, Herts.

WORCESTER ACTIVITY

I am interested to have news of the Worcester Society of Model Engineers. Little has been heard from them lately as they have been without a secretary, but I am grateful to Mr F. Leak of 56 Bishop Hall Crescent, Charford Estate, Bromsgrove, who has appointed himself temporary acting correspondent so that news of the society should not disappear from this page. Several promising models are under construction including a traction engine; a 3½ in. *Ann of Holland*; a *Hielan' Lassie* and 7¼ in. tank. Mr Leak feels that when they are finished and in service others will be started without delay. "Such is the lure of our hobby that steam locomotive construction did not end with the *Evening Star*. For every full size locomotive that is withdrawn it is replaced with a smaller but not less efficient engine," writes this enthusiast.

TALYLLYN SPECIAL

On Saturday at 8 a.m. one of 47XX 2-8-0 class locomotives of the Great Western Railway will steam out of Paddington at the head of the brown and cream Bristolian stock. Its destination will be Towyn-on-sea, Merionethshire. For this train will be the 1960 Talyllyn Special which conveys members and friends of the Talyllyn Railway Preservation Society to the annual meeting of the society at Towyn.

Tickets cost 62s. and are available from the London area secretary, Mr T. W. Robertson 23 The Portway, Ewell, Surrey.

CLUB DIARY

September 22 Bristol SMEE. Bits and pieces evening.

September 22 Rugby SMEC. Models night at Percival Guildhouse, St Matthews Street, Rugby at 7.30 p.m.

September 22 Harlington LS. Film about ocean going ships. High Street, 8 p.m.

September 23 Grimsby & District SMEE. Closing date for inclusion of exhibits in catalogue.

September 24 City of Leeds SME. Track meeting at Temple Newsam.

September 24 Sutton MEC. Shovelque Club House, Chatham Close, Woodstock Rise, 8 p.m.

September 24 Railway Enthusiasts' Club. North Kent Rail Tour. Apply to Rail Tour Bookings, Railway Enthusiasts' Club, Farnborough, Hants.

September 24 Birmingham SME. Visit to the Hilton Valley Railway.

September 25 Historical MRS. Tour of Forest of Dean. Details from K. Vincent, Cotswold Cottage, Teddington, Tewkesbury, Glos.

September 25 Ym 6m. OA and South London MYC. Metropolitan and Southern District Championship at Surbiton, Surrey at 10.30.

September 25 Malden and District SME. Locomotive trials at Claygate Lane, Thames Ditton, Surrey.

September 25 MPBA (West London MPBC). Regatta at the Round Pond, Kensington Gardens. Straight running only.

September 25 Poole MYC. Canada Cup event at 10 a.m.

September 26 Chingford and District MEC. Small gauge night.

September 26 Ipswich & District SMEE. Colour Slides and Cine Films of traction engines, models, etc., Gauge "1" garden railway, "Britannics." Talk and films by Messrs Burch, Lumkin, Mutimer, Benjamin. Catholic Hall, Spring Road, Ipswich, 7.30 p.m.

September 28 Wimbledon Model Railway Club. Track night at the clubroom, 32 Worple Road, Wimbledon SW19.

September 28 Harrow and Wembley SME. Talk by Vic Smeed on model boats.

September 29 Harlington LS. Lantern lecture by Lt-Col Tydeman. High Street, 8 p.m.

September 30 Coventry MES. "Scale and Gauge." General discussion. Centre Ballroom, Holyhead Road, 8 p.m.

September 30 Thames Shiplovers and Ship Model Society. Annual meeting at the Baltic Exchange at 6.30 p.m.

October 1 Bristol SMEE. Talk by Mr J. Rose on Hydroplane Racing.

October 1 Leicester SME. Public running at the track at Abbey Park, Leicester at 2 p.m.

October 2 Birmingham SME. Social day at Campbell Green.

October 2 YM 6m. OA and S. London MYC. M class Gravesend Bowl (open) at the Rick Pond, Home Park, Hampton Court, Surrey at 10.30 a.m.

October 2 Maidstone MES. Operation of the model race-car track and live-steam track at Mote Park at 11 a.m.

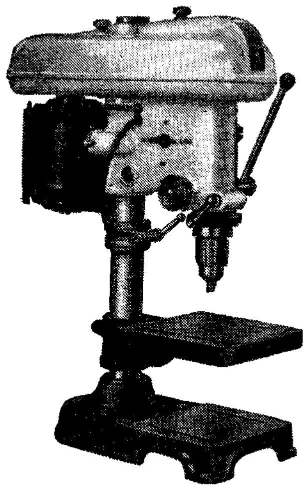
October 2 Poole MYC. Coronation Cup event at 10 a.m.

October 2 Harrow and Wembley SME. Pondside meeting at West Harrow recreation ground at 9.30 a.m.

October 3 Chingford and District MEC. Competition night at the headquarters.

BUCK & RYAN Ltd.

TOOL MERCHANTS



FOBCO DRILLING MACHINE

0-½" capacity

For 220/240 £42·18·6

For 400/440 £40·11·0

Mortising Attachment £6·13·6

Vice £4·1·0

CREDIT TERMS AVAILABLE

Leaflet on request

We always have in stock, a wide range of equipment for the model engineer

310-312, EUSTON ROAD, LONDON, N.W.1
Tel. EUSTON 4661

IRON WHEEL CASTINGS

1 in. Scale	*Diam.*	*Spokes*	*Each*
Bogie Wheels	3-5/16 in.	10	4/-
Driving wheel and coupled wheel ...	4-7/8 in.	14	6/-
Driving wheel and coupled wheel ...	6-1/4 in.	18	12/-
¾ in. Scale	*Diam.*	*Spokes*	*Each*
Bogie Wheels	2-7/16 in.	10	1/6
" "	2¼ in.	10	1/6
Tender Wheels	3⅛ in.	12	2/1
" "	3 in.	12	2/1
Driving Wheels	4⅛ in.	16	3/9
" "	4¾ in.	22	4/3
Driving or Coupled Wheels	5-1/16 in.	21	4/6
½ in. Scale	*Diam.*	*Spokes*	*Each*
Bogie Wheels	1-7/16 in.	10	10½d.
" "	1-9/16 in.	10	10½d.
Tender Wheels	2 in.	12	1/4
Driving or Coupled Wheels	2½ in.	14	1/6
Driving Wheels	2¾ in.	16	2/-
Driving or Coupled Wheels	3⅛ in.	18	2/6
Driving or Coupled Wheels	3-9/16 in.	20	2/10
Gauge "1"	*Diam.*	*Spokes*	*Each*
Bogie Wheels	30 mm.	10	1/3
Tender Wheels	35 mm.	12	1/3
Driving Wheels	43 mm.	14	1/6
Driving Wheels	54 mm.	16	2/-
Driving Wheels	63 mm.	18	2/-
Driving Wheels	67 mm.	20	2/3

All Prices Packing and Postage Extra

Note: we are unable to accept post orders under 7/6 in value.

CATALOGUES—Bond's Tool, Gear and Steam Fitting Catalogue contains 52 pages and illustrates our full range of Tools, Gears, Steam Fittings and Materials. **Price 1/9.**

Bond's Model Catalogue, Price 2/-.

BOND'S O' EUSTON ROAD LTD
357 EUSTON ROAD, LONDON, N.W.1
Est. 1887 Phone: EUSton 5441-2

PRECISION GEARS

Spur Gears — 24-100 D.P.
Bevel Gears Mitre & Ratio,
Worm Gears and Reduction Boxes,
Crossed Helical Gears — Racks,
Ground Shafting — Collars — Ratchet Wheels.

Send for complete list. ***Phone:*** **20231-2**

Made by *S. H. Muffett, Ltd.* Estd. 1920

PRECISION PRODUCTION ENGINEERS
Mount Ephraim Works, Tunbridge Wells

WE SPECIALISE

IN EVERYTHING FOR THE MODEL ENGINEER

MYFORD, ZYTO, UNIMAT, WAKEFIELD LATHES, BRIDGES, WOLF, B. & D. AND SELECTA HOMEMASTER UNITS

"Caley" universal cutting oil **2/-.** Post 1/-.
"Caley" super steam oil **2/-.** Post 1/-.
"Caley" steam packing $\frac{1}{16}$ rnd. **1½d.** foot.
⅛ rnd. **3d.** ⅛ square **7d.** foot.

PATTERNMAKING CASTING MACHINING

NO CATALOGUE MEANTIME S.A.E. ENQUIRIES

CALEDONIA MODEL CO.
478 ARGYLE STREET, GLASGOW, C.2.

Find that 'spare' you want . . .

through the pages of MODEL ENGINEER. With its wide circulation in clubs and to model engineers, an advertisement in the Classified columns will reach those most likely to be able to satisfy your need for a hard-to-come-by piece of equipment. And the rates are reasonable too—3d. a word for private persons (6d. a word for trade announcements), and the Box Number service costs 2s. extra. There is a minimum of twelve words, and if you want your name and address to appear this has to be paid for.

If you're having difficulty why not try our columns?