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Model Engineer

MAP HOBBY MAGAZINE

NEW "M.E." MODEL TRACTION ENGINE

Model Engineer

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Incorporating Mechanics and English Mechanics and Ships and Ship Models

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January 3 1969

COVER PICTURE

Ransomes Sims & Jefferies single-cylinder 7 n.h.p. engine No. 2700, built 1916 and owned by Mr B. N. Green of Beccles, Suffolk. Mr Green is now building a 3 in. scale model of this engine. Colour photograph by Adrian C. Muttitt of Bungay, Suffolk.

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NEXT ISSUE

The fire engines of John Ericsson: Uranus *doubled.*

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SMOKE RINGS

A commentary by the Editor

As we enter our 72nd year, the old question arises as to whether *Model Engineer* caters fairly for the very wide diversity of interests among our readers. I do not think there is any doubt that 1968 saw an increase in interest in the model steam locomotive, while if the entries in the M.E. Exhibition are anything to go by, there is now much more interest in stationary and marine steam engines.

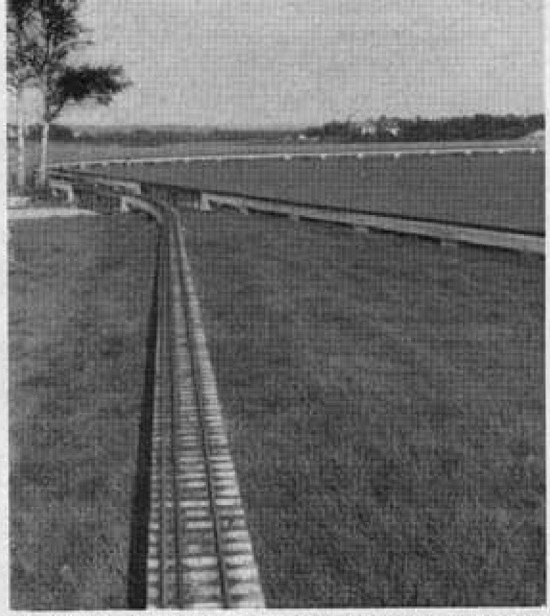
As a reader remarks in Postbag in this issue, we have not published anything on flash steam for some years. This is simply because nothing on this subject has been sent in, rather than any opposition to this form of motive power on our part. Flash steam is really an intensely interesting branch of the hobby. It would be surprising indeed if there is not at least one enthusiast who is experimenting with flash steam somewhere in this country, or perhaps overseas. Let us hope that this bold individual will see these words and send us details of his efforts.

As far as locomotives are concerned, I think that distinct progress in design has been made over the last few years. Coal-fired locomotives are generally more reliable; we seldom hear of lubricator troubles nowadays, and even injectors seem to have overcome an earlier reputation for unreliability. There have been some remarkable technical developments, such as many of the features in Mr L. J. Greene's outstanding freelance 0-6-0 tank locomotive, while I understand that one of the entries in Class "A" at the Exhibition is fitted with Caprotti poppet valves, an astonishing effort.

New Traction Engine

At long last, we can offer our traction engine enthusiasts a new full-scale constructional series on building a 1 in. scale model. For years now, we have been asked when we were going to follow up the excellent series by Bill Hughes on the 1½ in. scale Allchin with something a bit different and to another scale. Mr L. C. Mason, who is well known for his books and articles on lathe work and also for his small petrol engines, starts off the articles on the construction of the new M.E. traction engine, which he has been building during the last twelve months. The actual engine, still not quite finished, is on view at the Exhibition at the Seymour Hall.

I am sure that this engine will prove even more popular than the original 1 in. scale M.E. traction engine, which was designed by the late Henry Greenly, and which was later modified by Mr Ernest Steel.



A view of the new track of the Bournemouth Society. (See last issue.)

The double traverser.

Below: The lifting bridge raised and locked. Photographs by D. E. Lawrence.

INTRODUCING "*MINNIE*"

The New Model Engineer

TRACTION ENGINE

A one-inch scale model built and described

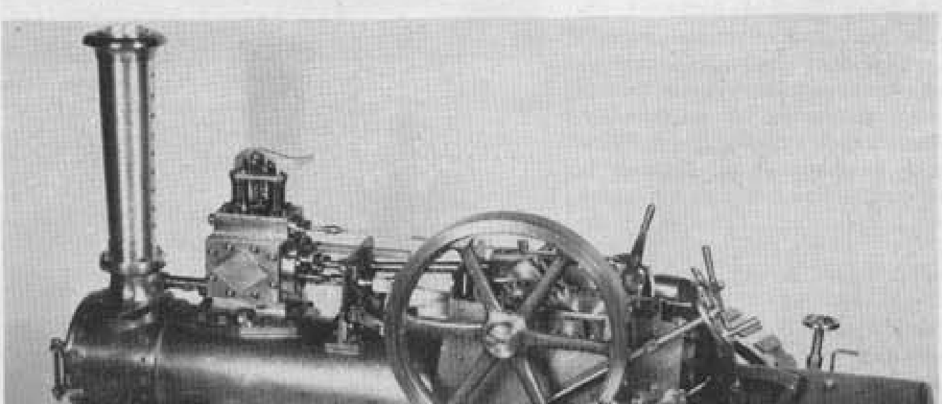
by L. C. Mason

IT IS PROBABLY TRUE to say that in recent years the large scale steam locomotive has gained in popularity at the expense of the smaller gauges.

This has never been true of traction engines, for which the most popular size has always been the 2 in. scale model. This gives a robust engine capable of real passenger hauling and large enough for quite small detail on the full sized job to be faithfully reproduced on the model. The two-inch model generally results in an engine some three feet long and weighing a hundredweight or more. While this can be an attractive engine to operate, it is not everyone's most convenient size to build. Storage can be something of a problem, too.

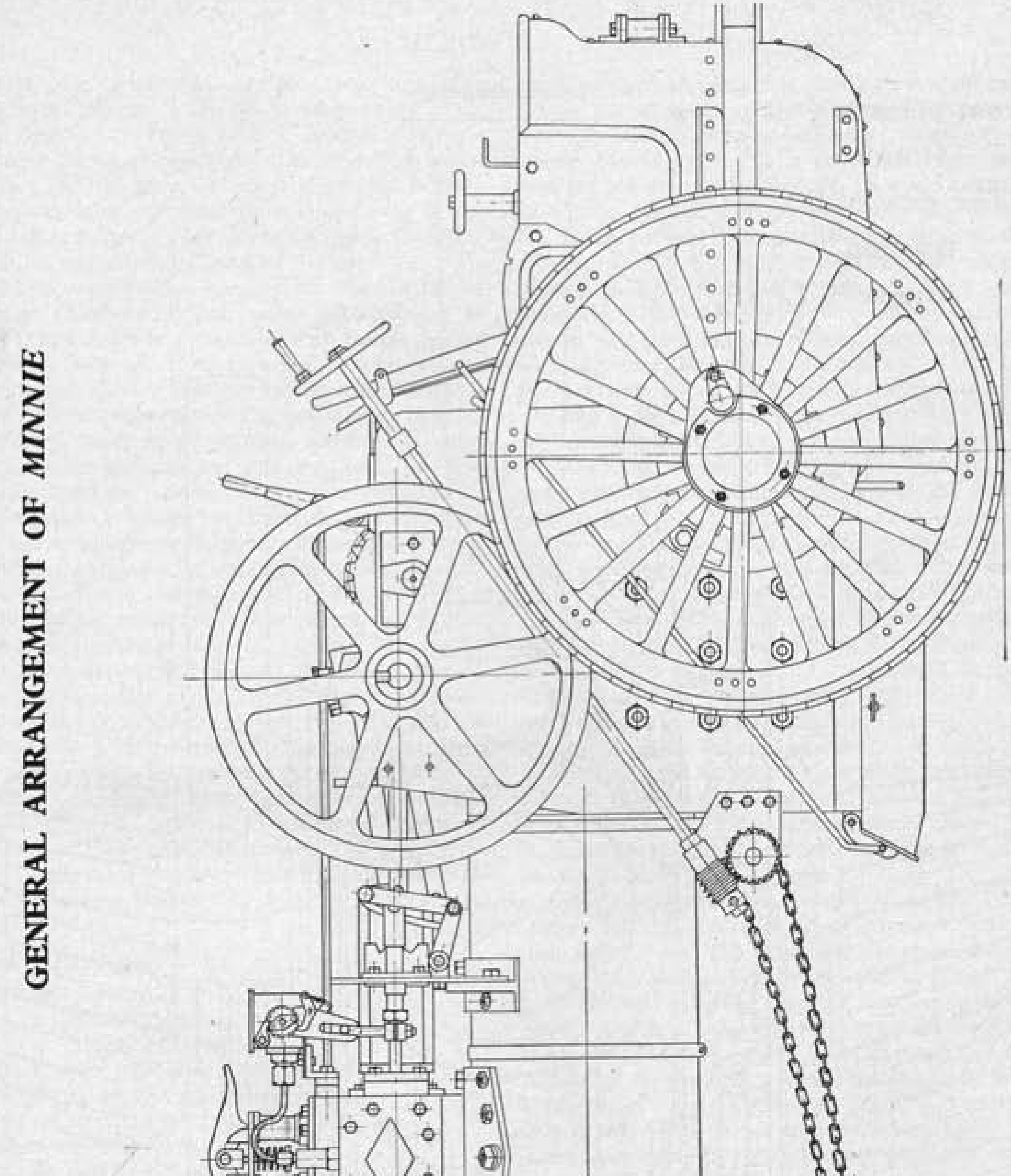
The 1½ in. scale is that much more convenient to handle and can be looked on as a "single-handed" engine, but designs in this size are not very numerous.

The prospective builder confronted with a new design looks first at the flywheel and rear wheel diameters, mentally assessing his lathe capacity for turning these items. Even in 1½ in. scale rear

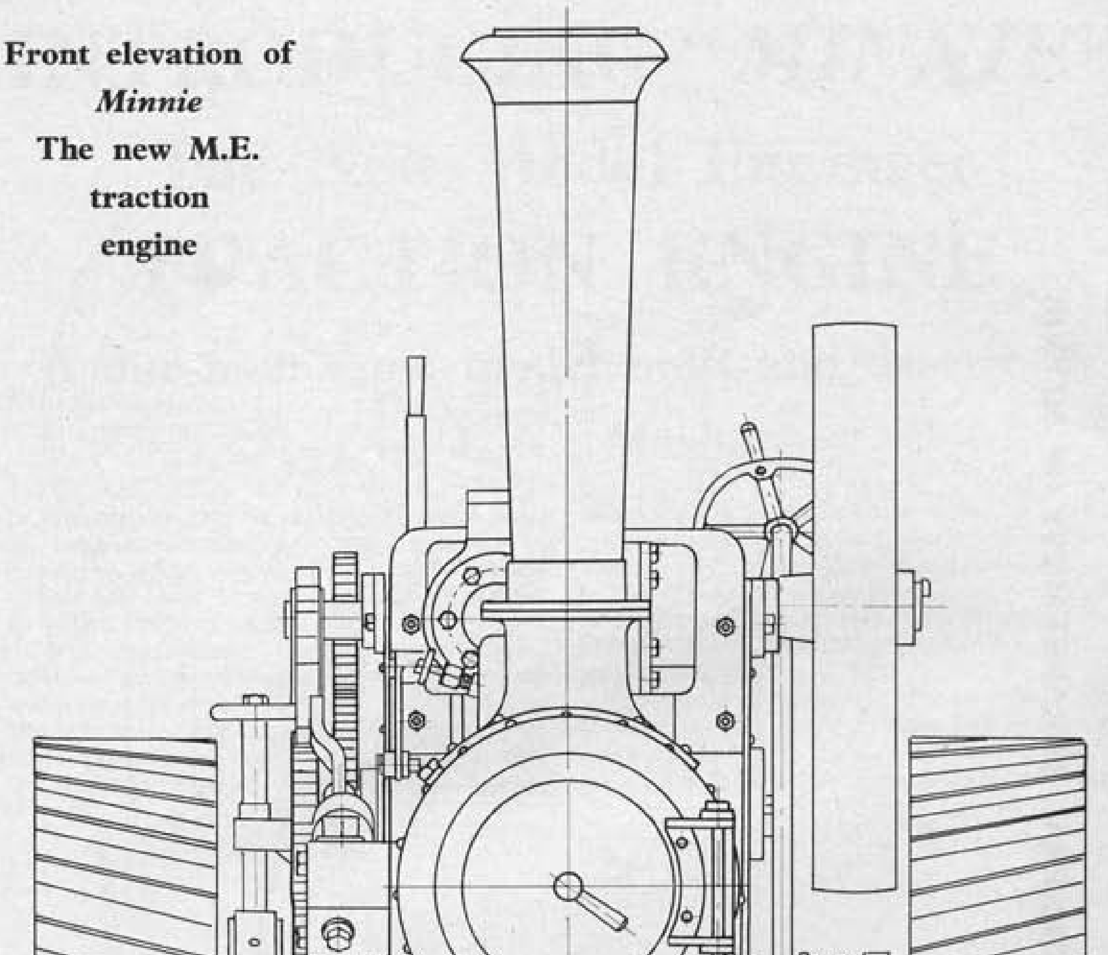


A near-side view of "Minnie." The New Model Engineer one-inch scale traction engine by L. C. Mason

GENERAL ARRANGEMENT OF *MINNIE*



Front elevation of
Minnie
The new M.E.
traction
engine



wheels of around 9 in. dia. are something of a faceplate "wangle" on the normal 3½ in. lathe. You could of course do what a determined friend of mine did when building a 2 in. model on a 3 in. lathe. He had the rear wheel rims cast in light alloy, carefully smoothed them round with a file, and left it at that! They were reasonably true, too. Still, he was no mean hand with a file.

On all counts then, one can assume that a still smaller scale would hold some attractions. If one comes down to 1 in. scale, then things rapidly begin to look much more possible with normal equipment. Major diameters to be turned become much more manageable, the boiler size involves distinctly smaller components—promising easier silver-soldering—and last but not least, the cost of materials and castings is considerably less.

This size is somewhat small to include every item of a definite prototype as a working feature; a working governor, for instance, would be "watch-making" in the extreme, with a fair chance of it failing to be satisfactory when fitted. However, if one is prepared to forgo the pleasure of knowing that a full-size version of one's own model actually exists, a free-lance 1 in. scale engine can still incorporate reasonably correct full-size practice.

Builders of model traction engines are fortunate in one respect, in that the prototype varies so much individually that almost any particular combination of features you care to dream up almost certainly exists somewhere!

So with these considerations in mind, the free-lance 1 in. scale design for "Minnie" is presented.

Vital statistics are:

Overall length: 18 in.
" width: 8¼ in.
" height: 11¼ in.
Rear wheel dia.: 6 in. × 1⅝ in. wide.
Front wheel dia.: 3⅞ in. × ¾ in.
Wheelbase: 10½ in.
Flywheel dia.: 4½ in.
Single cylinder: ⅝ in. bore × 1 in. stroke, steam jacketed.
Boiler dia.: 2½ in.
Tubes: 9—⅜ in. dia.
Firebox: 2 in. × 3 in.
Working pressure: 50 p.s.i.
Boiler feed: Boiler mounted pump, ¼ in. bore × 5/16 in. stroke.
Gears: All gears 20 d.p., stock items by Bonds.
Ratios: Low gear: 16 : 1.
High gear: 10 : 1.
Weight: 26 lb.

The design has been kept as simple as possible consistent with a reasonable looking engine. For this reason there is no compensating gear; nor is there an injector, nor three speeds, nor spud pan. By the knowledgeable and experienced these could probably be fitted with the necessary modifications to the basic design. It is shown as a straight-forward general-purpose engine. It could be built as a road tractor, without any major alterations, by fitting rubber tyres instead of strakes to the wheels, a disc flywheel instead of the spoked version, and the fitting of a canopy. My wheel-filing friend built a very nice compound showman's engine—his third traction engine model, incident-ally—and on completion I asked him: "So what's the next one going to be, another showman's?"

"No, I don't think so," he said. "Why make all that beautiful motion work and then cover it all in so that it can't be seen?" Perhaps the same considerations will apply here to the fitting of a canopy.

You can start to build a model traction engine with any particular component that takes your fancy, of course. Some people start with the rear wheels, on the grounds that the initial enthusiasm makes light work of some patient detail work, and on completion you have a realistic piece of traction engine to look at and play with. Building a loco-motive generally starts with the main frames. While a traction engine has no main frames as such, the boiler to a large extent does the same job. So it seems to me that the logical place to start building is with the boiler. So very many things depend on it. It carries the hornplates for one thing, on which numerous bits are lined up.

Actual dimensions—and slight variations from them—can have far-reaching effects, so it pays to look ahead a bit. For instance, the measurement across the hornplates governs the width of the front end of the tender where it attaches to them. Both boiler and tender have definite dimensions, but it is extremely easy to vary fractionally from laid-down dimensions in boiler-making, especially if you haven't done much of it. Surely it is prefer-able to have the tender say, a fraction fuller on width than stated to exactly fit the hornplates, than to make it spot on dimensionally and then have to bend it to fit.

On construction in general, I confess to being a "fabricate-it" type, by which I mean that I normally prefer to build up and then machine a small item rather than clean up a casting and then machine that.

The amount of work involved in each case is often much the same and you often get a neater component where angles and internal corners are concerned than is possible in a casting, unless a disproportionate amount of time is spent on it. There would seem to be little point in making a

Continued on page 29

BOILERS FOR BEGINNERS

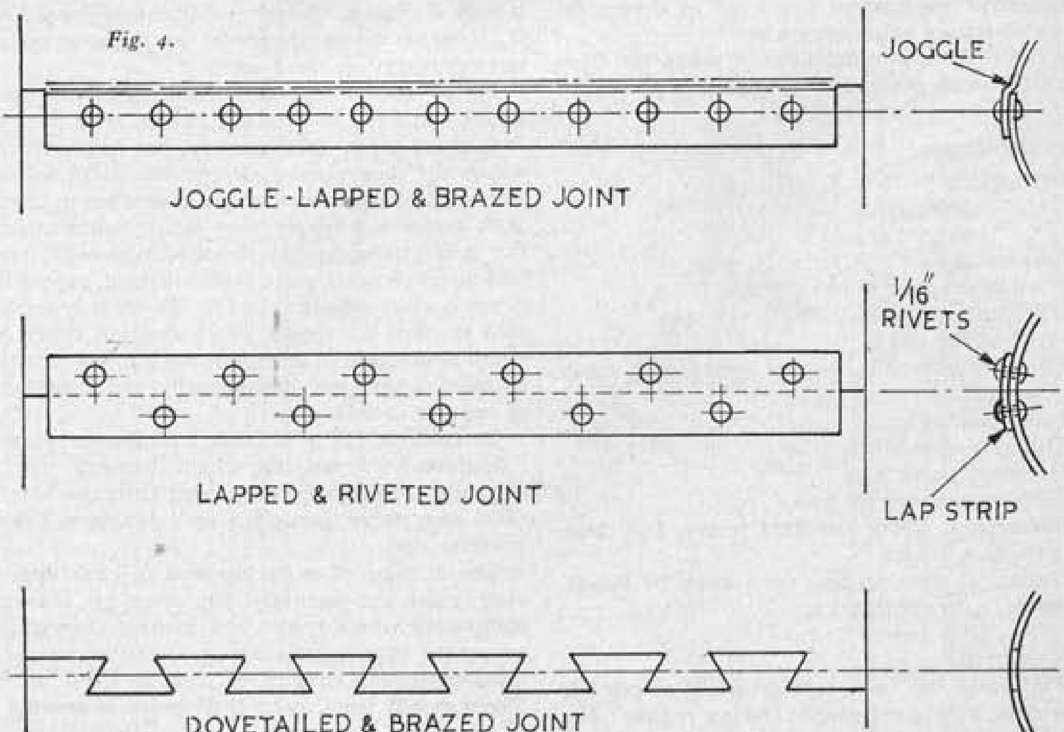
Part II. **by Edgar T. Westbury** *continued from page 1208*

IF THE SEAMLESS copper tube specified for the boiler shell is not readily obtainable, it is possible to make it from sheet copper, bent or rolled into cylindrical form, and jointed in such a way as to ensure that it will withstand the maximum pressure likely to be applied. Here it may be mentioned that the thickness of metal I have specified, 16 s.w.g., or approximately $\frac{1}{16}$ in., is considered unnecessarily heavy, according to some experienced constructors with whom I have discussed this subject. It is suggested that thinner material would enable the heat to be conducted to the water more rapidly and thus promote steam generating efficiency. I believe, however, that this is a fallacy, because metal is a better conductor of heat than water, and even if a thick boiler structure may take a longer time in initial steam raising, (by no means certain), it is not at any disadvantage in the rate of heat exchange under normal working conditions.

In any case, I am content to lean over backwards in ensuring a high margin of safety in the structural materials of boilers. I do not dispute the calculations for " hoop strength " of cylindrical shells, which are given in engineering text books, but in constructional practice, they do not take into consideration the deterioration in strength which may take place over a long period of working life under varying stress, or either general or local erosion when in service or laid up. The difference in weight between a sturdy and a flimsy boiler is not worth worrying about, unless one is splitting hairs over the total power/weight ratio of the steam plant.

The form of joint which can safely be used for a sheet metal boiler shell may be varied, provided that strength can be guaranteed. Some shells have been made with the edges of the sheet simply bolted closely together and brazed, but it is not always easy to avoid warping or displacement

Fig. 4.



during the operation. To avoid this, a row of holes may be drilled along each edge, and thick copper wire staples used to "stitch" the joint together. Other methods are indicated in Fig. 4, the first being the joggle-lapped and brazed seam, reinforced by a row of rivets; to carry this out neatly, and avoid complication in fitting the endplates, a special seaming tool may be called for. The fitting of a lap strip, with two rows of rivets spaced not more than ½ in. apart, may be found simpler. Large boilers sometimes have lap strips both on the inside and outside, but this is not necessary in the present case, because if the joint is to be brazed, the function of the rivets is more to locate and ensure close contact of the parts than to take mechanical strain.

The interlocked or dovetailed brazed joint is in my opinion the best and neatest for cylindrical shells, and is not difficult to carry out. After fitting the dovetails as closely as possible, and forming the shape on a mandrel, the edges may be burred over just sufficiently to prevent them shifting during the brazing operation. In cases where rivets are used, they may be of the snaphead type (copper, of course) 1/16 in. dia., inserted from the inside, and just long enough to provide the usual "dia. × 1" or slightly less, for heading. If they have to be cut off to length, the end faces should be squared off, not left as cut by pliers or hacksaw.

The simple device shown in Fig. 5 is useful for trimming rivets to correct length and is worth making, even if not more than about a dozen rivets have to be dealt with. It consists of a strip of flat steel bar, of a thickness equal to the length of the required rivet shank and drilled to take the rivet from the underside. A turnbuckle is fitted underneath, and adjusted so that it wedges the rivet head firmly when in position, but can be swung out of the way for inserting or removing the rivet. When in position, the shank can be cropped as closely as possible with cutting pliers, and then filed down flush with the surface of the flat bar. When drilling holes for rivets, I prefer to fit them fairly closely, with no more clearance than is necessary to push them through easily, and clean off burrs on both sides of each hole.

For heading the rivets, I recommend supporting the pre-formed snap heads by a substantial rectangular or round bar, having a dimple drilled in it to form a seating for the rivet (Fig. 5). A bar of, say, 1½ in. dia. can be held securely in the *throat* of the normal bench vice, below the jaws, with an overhung length sufficient to reach the furthest rivet. It is not usual to take the same care to produce tidy riveting as in outside (and visible) work, but it is not a waste of time to use a small snap punch to shape the rivet heads neatly. It will be seen from Fig. 4 that when lap strips are used, they stop short of the ends of the shell to allow for the rim of the endplate. The length of material for the boiler shell should be made equal to the circumference of the tube (for a 2 in. shell, this is 6 9/32 in.) plus the required lap for the joint; for the dovetail joint, this is the depth of dovetails on one side, not both. After the joint is brazed, and pickled to remove scale, it should be smoothed down on a mandrel to true circular shape, squared up on the ends and scoured clean on the endplate contact surfaces. The joint in either cases is located on the underside of the boiler shell.

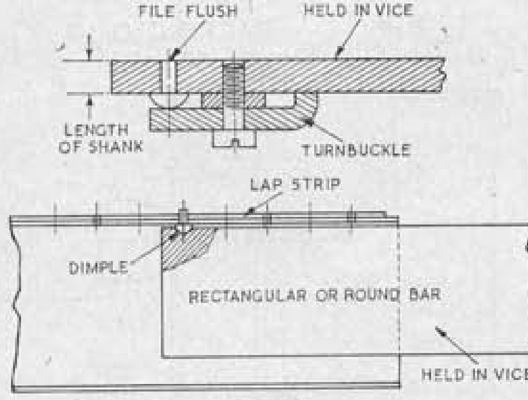


Fig. 5.

Forming the endplates

Most boilermakers form flanged plates of any shape by beating over a suitable former, and the same method can be used for the simple endplates used for this boiler, but I question whether it is the easiest or the neatest method possible in the hands of the inexperienced worker. The technique involved is fully explained in the handbook *How to Work Sheet Metal* by that master craftsman Herbert Dyer, and has also been dealt with by other M.E. contributors. But whatever method are adopted, it is essential that the metal should be previously annealed, and that this should be repeated as many times as may be necessary during the forming operation. To judge by many queries from M.E. readers, the importance of taking full advantage of *ductility*—one of the most valuable properties of copper—is not fully realised.

In a recent query, a reader stated that he knew that it was usual to recommend heating copper to a *dull* red heat prior to quenching in cold water, but he thought it could be more effectively annealed if first brought to *bright* red. There is no evidence, however, that this is so, and one reason why it is not prudent to raise the temperature higher

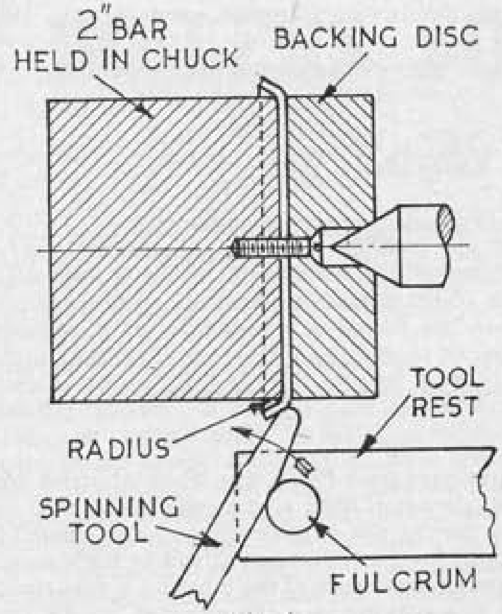


Fig. 6.

than necessary is to avoid risk that the nature of the copper may be permanently changed for the worse. It has been stated that copper is liable to become porous if overheated for any length of time. The same reader said that he found it necessary to re-anneal the copper ten or more times in order to flange it properly. The number of annealings required will depend on skill and experience—knowing where and how hard to strike—but they should not be grudged or delayed when the metal becomes hardened under the hammer.

Spinning endplates

I find that plain circular endplates can be flanged quite easily by spinning in the lathe. A simple and preferably rugged lathe is best for work of this nature, and it should be capable of standing up well to end thrust, as this is the major load encountered. For simple operations in 16 sw.g. copper, a normal 3½ in. lathe is adequate if kept well lubricated. Assuming that the boiler shell is within fairly close limits of 2 in. diameter, the former may be made from a piece of 2 in. metal bar, faced flat on the end, with a small radius on the end, and well finished. A backing disc of the same size is used to clamp the blank, which needs to be about 2⅜ in. dia., and driven by friction. In Fig. 6, I have shown a small screw fitted in the centre of the blank, and this will assist in centring it and reduce the end thrust required on the back centre. Experienced workers often dispense with the hole for a centre screw, and clamp the blank by end pressure alone, but this calls for setting it to run concentrically, and it is advisable to use a ball or roller bearing back centre to avoid risk of seizure at this point.

The tool rest for spinning may be adapted by fitting a special head to a simple T-rest, or a flat bar held in the toolpost. In either case one or more holes should be provided to take a stout peg which serves as a fulcrum for applying leverage to the tool. The latter may have a tip of round or oval section, highly finished and hardened, also fitted with a handle like a wood turning tool for convenient manipulation. For an operation of this kind, the lathe may be run at middle direct speed, and the blank must be well lubricated. The old time-honoured lubricant is tallow, and I have yet to find anything better, despite having tried all the more modern oils and greases. In applying the tool, gentle pressure should be used at first, to deform the blank uniformly without forcing it into waves, and it should be possible to turn the trim over about 30 deg. at the first annealing. Greater pressure on the tool can be used in further stages, until the rim lies down snug on the former and has a highly burnished surface. To finish the operation, the edges of the rim, which may be left somewhat uneven, may be trimmed with a left-hand side turning tool.

Centre stays

In the sectional drawing of the boiler assembly, I have shown three stays, 3/32 in. dia., passing longitudinally right through the shell and screwed 7 BA at each end. This is in the interest of maximum strength, but it has been found that a single central stay ⅛ in. dia., screwed 5 BA, will serve the purpose adequately. In either case, the screwed ends should project to enable them to be used to support the boiler in its casing, and a tapped collar or thick nut is screwed on just tight enough to hold each endplate in place, and form a distance piece between the boiler and the casing ends. If a single central stay is fitted, care should be taken to avoid excessive projecting length which might interfere with the fitting of a gauge glass.

Boiler fittings

Before the boiler is finally assembled, provision should be made for any fittings which may be considered necessary. A horizontal boiler needs at least two outlets from the cylindrical shell, for the steam outlet and the safety valve, which may be removable for filling the boiler with water if a third outlet is not considered worth while. If desired, tapped bushes may be permanently brazed into the shell in each case, and it is possible to fit a stop valve directly to the steam outlet, but the arrangement shown in the drawing, where a blind

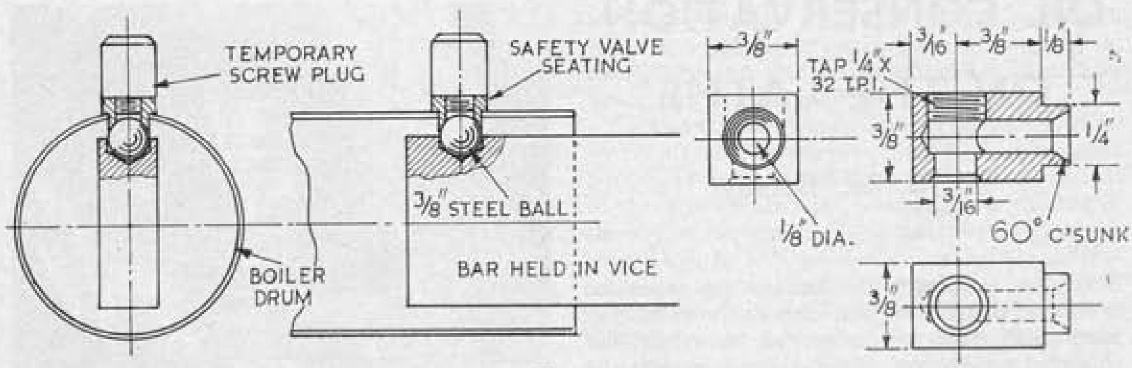


Fig. 7.

bush with a side connection to the superheater coil is brazed into the shell, is simpler and really to be preferred. A stop valve, if fitted, should be located at the "dry" end of the superheater or elsewhere in the steam line. Ready-made safety valves are available, but I shall be showing one which is simple to make and reliable in action. I recommend a valve with a bore of not less than 1/8 in. through the seating, and screwed 1/4 in. by 32 t.p.i. The shouldered bushes to take the fittings should fit closely in holes drilled in the boiler shell; it is best to drill small holes first and open them out with a pin drill, finishing with a taper reamer. A direct attack with a drill of the *full* size generally causes snatching, and results in a ragged hole which is any shape bar circular.

It is my policy to expand the bushes on the inside so that it is impossible for them to be blown out, even if the soldering or brazing should fail.

This can be done by the method shown in Fig. 7 in which a 3/8 in. steel ball is located in a hole drilled to about half its diameter in the holding-up bar. The mouth of the bush should be chamfered about 60 deg., and when in position in the shell, it is located over the ball and given a few sharp blows. To protect the face of the safety valve seating from risk of bruising, a dummy screwed plug should be screwed in as shown. Make certain that the bushes are fully home to the shoulder: they should be riveted tight enough to resist being moved, before brazing in.

Gauge glass fittings

Many small boilers have no provision for observing the amount of water they contain, and provided that care is taken to remove the heat if they boil dry, no harm is usually done. Sometimes test cocks are fitted above and below the intended water line to check if there is sufficient water for safe working. But a gauge glass which gives visible indication of the level is a great convenience, if nothing else. There is, however, a practical problem in applying a gauge glass to a boiler having a limited diameter of drum, because even if the connections to it are taken from the highest and lowest points, glands of any type used for sealing the gauge glass take up so much room that the visible length of the glass is inconveniently short. I have experimented with gauge glasses cemented into the fittings, instead of using glands, and have found them quite satisfactory, provided that the cement used has an affinity for both glass and metal, and is not softened at high temperature. Some of the commercially made model steam plants have had gauge glasses cemented in with a compound of white lead and litharge. A modern thermo-setting epoxy resin adhesive, such as Araldite or Britfix 88, would give a more tenacious seal.

The fitting for a gauge glass is shown in Fig. 7. It is made from 3/8 in. square brass rod, which may be held in the four-jaw chuck for turning the spigot and drilling the blind hole. The cross hole may with advantage be drilled and tapped before the axial drilling, in order to avoid or at least reduce inaccuracy as the holes break into each other. Two such fittings are required, but only the top one needs to be tapped to take a closing plug. The cross hole should be a close fit for the gauge glass and chamfered at the mouth, to assist in applying the adhesive. Both fittings, after insertion in holes in the endplate, can be expanded with the ball pene of the hammer, or by means of a 3/8 in. steel ball as for the previous operation. To line them up while this is being done, a straight 3/16 in. rod should be passed through both of them. The distance of the gauge glass from the endplate must be sufficient to clear the outside of the casing, but should not be excessive.

If the conductor rods (or any other device for increasing efficiency) are to be fitted, the holes to receive them should be drilled 5/32 in. dia., and tapped 3/16 in. × 40 t.p.i. The rods, screwed to the same thread on the ends, can be screwed in tightly prior to soldering or brazing. *To be continued.*

OIL CONSERVATION ON THE LATHE

by S. U. Belsey

THAT OIL is cheap while bearings are expensive is so true that no-one will dispute the fact. But most small lathes are lubricated by a total-loss drip-feed system, and all oil which flows into the bearings must eventually flow out of them. The result is that one finds the lathe standing in a moat of oil and half-submerged swarf. And if this oil is allowed to stand in a glass jar and settle, it looks as good as new, but cannot safely be used again as it is contaminated with cutting-oil and finely-divided swarf.

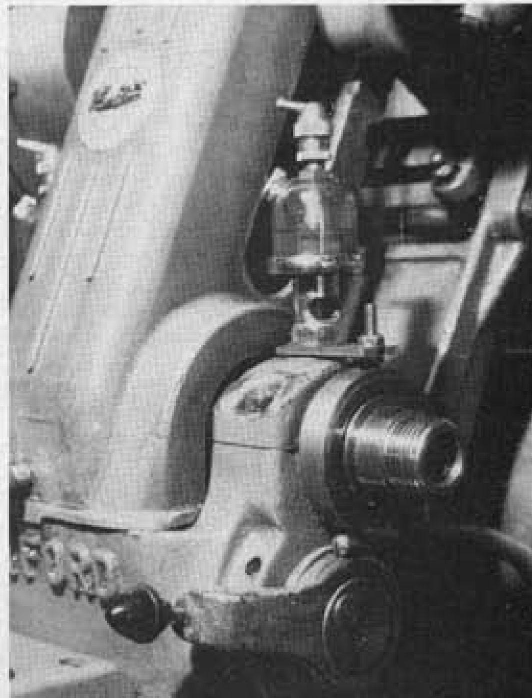
A major proportion of the lubricating oil comes out of both sides of the mandrel bearings. Some drips from the change-wheel cover, some through the hole in the headstock casting and some, most annoyingly of all, is thrown from the collar at the mandrel nose in a spray which makes little black dots on one's overall and everything else it hits.

The primary purpose of the arrangements about to be described is to collect the oil in an uncontaminated and re-useable condition. A second purpose from a practical point of view is to prevent oil from being thrown about the workshop when the lathe is being run at high speed, and to prevent it making a mess of the lathe drip-tray.

If both these purposes are achieved, oil supplies to the mandrel bearings can be increased, so that the oil can act as a coolant and lengthen bearing life if the lathe runs for any length of time at high speed.

To deal first with the most annoying oil emission, which is from the lathe mandrel nose, a collar was made to provide sealing and drainage. A mild steel ring 2⅜ in. dia. by 7/16 in. thick was turned up as shown in Fig. 1. It was counterbored to give a groove ⅛ in. deep and a recess 1/16 in. deep by 2⅛ in. dia. The actual sealing member was a plastic ring with an inside diameter to fit closely upon the mandrel nose collar, which is 1⅝ in. dia. The plastic ring outside diameter was made to fit in the recess in the steel ring, and it was secured in place with Araldite. A slot was made in the bottom of the ring for oil drainage.

To locate the ring a 2 BA stud 1 in. long was screwed and soldered into the top of the ring (see Fig. 1). The lathe drip-feed lubricating cups screw into the bearing caps with ample thread



The mandrel nose oil-seal in place.

depth, and provide a ready means of locating light attachments. Therefore, a piece of ⅛ in. thick brass strip ¾ in. wide by 1¾ in. long was drilled 7/16 in. dia. ⅜ in. from one end. An open ended longitudinal slot 3/16 in. wide by ⅞ in. long was cut in the opposite end, as shown in Fig. 1. The strip was quite adequately located by passing the screwed stud of the lubricator cup through the pipe in the strip, with fibre washers above and below, and screwing it into place into the nose-end bearing cap. To carry the sealing ring the seal was slipped over the mandrel nose collar and the 2 BA stud was entered into the slot in the end of the strip. Nuts and washer above and below the strip secured the sealing ring in place, and provided upward and downward adjustment for minimum friction between the seal and the mandrel nose.

To take the oil drainage from the collecting collar, which was already slotted for the purpose, a piece of brass rod ¼ in. o.d. by 2 in. long was drilled No. 26 for a depth of ¾ in. The rest of the length of the rod was drilled 3/16 in. and the ¾ in. by 26 hole was tapped out 2 BA. Next an arc was filed out of the side of the rod to fit the underside of the collecting collar. The maximum depth of the arc was ⅛ in. and the filed-away part of the rod was soldered into place on the bottom of the collar (see Fig. 1). The threaded end of the hole was

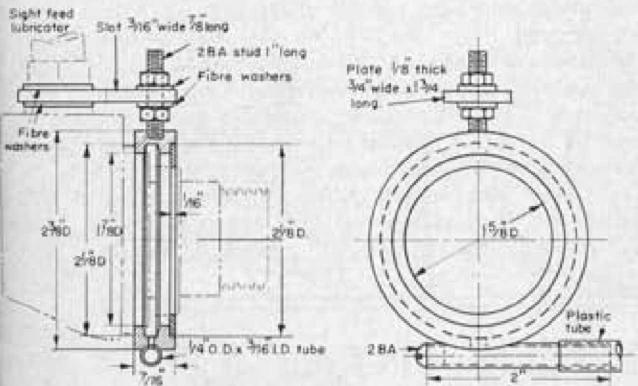


FIG. 1 MANDREL NOSE OIL SEAL

closed by screwing in a 2 BA set-screw, which formed an easily removed plug for cleaning purposes. A length of ¼ in. int. dia. plastic pipe was slipped over the other end of the brass rod. Oil drainage from the outside end of the rear mandrel bearing distributes itself over the lathe change-wheels, exactly where it will do most good, suffering no deterioration in the process. If a quick-change gearbox is in use, the change wheel set-up is largely undisturbed, so oil has time to drip on to the inside of the change-wheel cover, to drain into the swarf-tray—and to make a mess.

To salve the oil, an ordinary round ½ lb. cocoa tin was cut in halves lengthways, and the sharp edges of the tin were turned over (see Fig. 3). The lid was soldered on and a ¼ in. hole was drilled through what was to be the bottom of the collecting trough near the lid. A stub for attaching a drain pipe was made by turning down a 1½ in. length of ½ in. brass rod to ¼ in. dia., drilling it through 3/16 in. and parting it off to leave a flange 1/16 in. thick. This stub was pushed through the hole from inside and soldered into place.

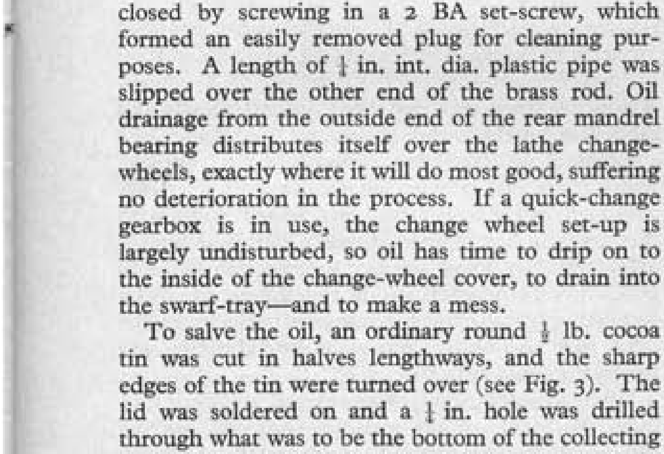


FIG. 2 INTERNAL HEADSTOCK FUNNEL & CHUTE

To suspend the trough under the change-wheel cover, a bracket was made from brass curtain-rod ⅝ in. × 1¼ in. and soldered to what was the bottom of the tin. This bracket is hooked over the end of the slot on the guard. To secure the lid-end of the trough a 3/16 in. hole was drilled through the change-wheel cover and another through the tin-lid rim. A short length of 2 BA rod (or a bolt will do) was passed through the hole in the cover downwards, and locked into place with a couple of nuts. Another pair of nuts secured the lid-end of the collector trough into place at an adjustable angle. Slipping a length of plastic pipe over the brass stud allowed oil to be led away to the drain collector mentioned before.

For some obscure reason, suicidal moths and other assorted insects seemed to find this oil collector an irrestible attraction and choked the outlet pipe with their bodies. Accordingly a piece of perforated zinc was cut to fit the tin, and it effectively kept the outlet clear, ready to lead the oil drainings away to any convenient receptacle. My own drainage collector is a " Castrolite " oil tin, one pint capacity. These oil tins are closed by a plastic strip which when removed leaves the top of the tins intact, except for two holes. This allows the plastic pipe to be inserted straight into the tin and keeps out swarf and dirt.

Collection of drainage from inside the lathe headstock was a more difficult proposition. A hole 1½ in. wide is cored into the lathe bed beneath the headstock itself, and oil drainage runs through this hole into the lathe swarf tray. This oil is uncontaminated, so if it can be collected it can be used instead of making a mess in the tray.

To collect the oil which previously ran to waste, a tundish was required. At once a snag was apparent. Space inside the headstock casting was limited and nearly all of it was occupied by the mandrel and back-gear. The obvious answer would have been to remove the head-stock casting and to make a tundish to fit into the hole in the lathe bed. An oil-tight joint between the tundish and the bed could have been made with Araldite. This can be done if one is prepared to risk upsetting the alignment of the mandrel. I preferred to leave my lathe headstock in peace and undisturbed, and I feel that most of my fellow amateurs would share this view.

A tundish was made which would fit into the available space and which would extend under the edge of the headstock casting at the change-wheel end. This feature was necessary in order to catch

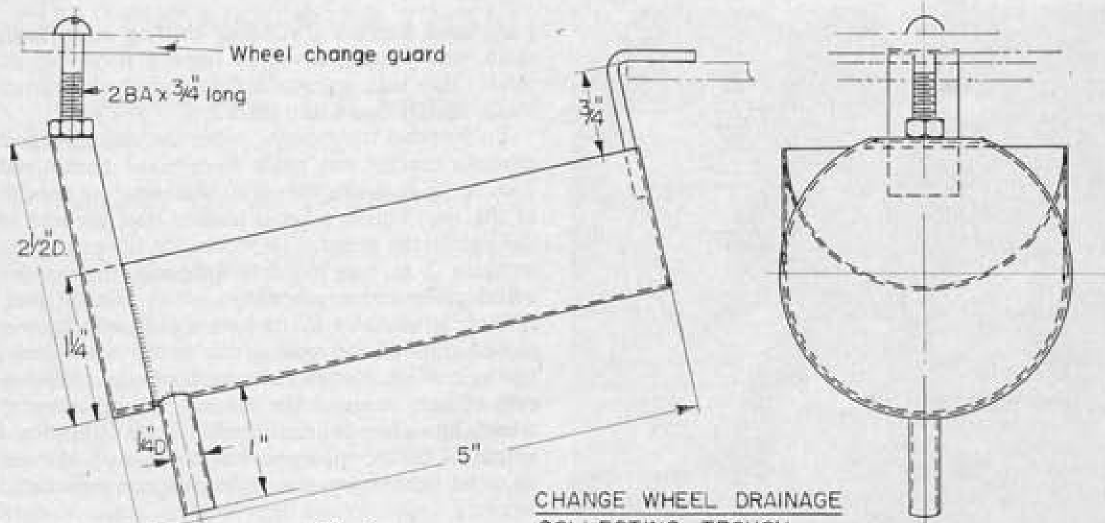


FIG. 3

CHANGE WHEEL DRAINAGE COLLECTING TROUGH

the drainage from the inside of the mandrel bearing at this end.

The tundish was made to fit snugly into the space beneath the back-gear countershaft in order to clear the large wheel (see Figs. 2A and 2B). The general shape and dimensions of the device were as shown. It was secured in place by 4 BA bolts passed through holes in the lugs (A) and (B) and threaded into 4 BA tapped holes in the lathe headstock casting at (A) and in the lathe bed at (B). The lip (E) collects oil flung from the back-gear large wheel.

In order to deliver the collected oil to the Castrolite oil tin, now dignified by the appellation of "drain-collector," a stub-tube 1 in. long by ¼ in. dia. was made with a flange ⅜ in. dia. (Figs. 2A and 2B). A hole was drilled through the bottom of the tundish, the tube was aligned under it and the flange was soldered into place. A piece of plastic tubing was slipped over the stub leading to the drain collector.

Fitting the tundish into place was quite a tricky business. The first job was to remove the lathe mandrel, and, of course, this was a straightforward operation. The back-gear countershaft also had to be removed, and this was more complicated. First the back-gear cluster was removed by undoing the Allen screw at the end of the spindle on which it revolved. To remove the back-gear axle-unit the two Allen grub-screws in the operating lever were removed, allowing it to be taken off. The axle was then withdrawn inwards, leaving the headstock clear of the obstruction.

The tundish was manoeuvred into place and tried for fit with the left-hand end well under the edge of the headstock casting as described before. The screw-holes in the tundish fixing lugs were marked-off on the headstock and bed, drilled No. 34 and tapped out 4 BA.

Before final installation, a length of ¼ in. int. dia. plastic pipe was pressed on to the stub (C) (Fig. 2B), as it would have been very difficult to fix with the tundish bolted into place. Plastic piping is fairly rigid, so it was warmed and bent to shape so as to fit into position inside the lathe bed. The tundish with the plastic pipe in position on the brass stub was bolted into place, and the pipe was led to the drain collector.

With the described arrangement, oil drainings from the inside of the mandrel nose-end bearing can evade the tundish and gravitate to the lathe drip-tray. Therefore a shute was made as in Figs. 1A and 1B. With dimensions as shown, the lip (D) bolted on to the lathe bed. The right-hand edge of the shute (Fig. 1A) extended beneath the bearing, so oil drainings are led to the tundish.

With the tundish and shute in place the back-gear was replaced, but here a warning is necessary. The "in gear" and "out of gear" positions of the back-gear wheels are determined by the relative positions of the operating lever and the boss on which it fits. The lever must be fitted in exactly the same position as it was originally, or gear meshing will be impaired and the large gear may foul the tundish lip (E). The lever is secured by two Allen grub-screws which each leave a neat little O-shaped mark on the back-gear boss. Therefore, when the lever was being replaced, it was manoeuvred until these marks could be seen through the grub-screw holes. An ex-W.D. dental inspection mirror was useful for this job.

To complete the reinstatement, the back-gear cluster was replaced, the complete unit was tried for engagement and freedom of rotation, and the lathe mandrel and its bearing caps were assembled into position.

These very simple modifications have been in operation for some months now and have proved even more successful than I had anticipated. The fact that I have saved nearly a pint of oil has become of secondary importance to the improved cleanliness of the lathe, as the only serious oil drainage to the drip tray comes from the saddle nipples and from cutting oil. My lathe, a ML7, has a high-speed drive, the top speed being some 1,900 r.p.m. and it is quite a relief to see the mandrel going contentedly about its business with a really generous flow of oil. Of course, the oil cups have to be filled frequently, but I have an old motor-cycle engine oil pump and maybe some day I shall devise an overhead gravity-tank supply, with a continuous topping-up from the drain-collector, using that old oil pump—who knows ? ■

A LATHE SLOTTING ATTACHMENT

by J. A. Radford of New Zealand

ONE OF THOSE NECESSARY engineering operations usually done in the lathe by model and amateur engineers is slotting. This is usually done by mounting a boring tool under the toolpost with a flat-ended tool set on its side and the saddle is racked along the bed by the traverse handwheel. It is very distressing to most of us to feel the strain imposed on the saddle gears and to know the strain imposed on the slide ways by this operation. I have, in the past, been in the habit of pushing the saddle along by means of the tailstock which is a rack feed type with a pad centre pushing directly on the end of the tool.

By this means a lot of the strain is eliminated, but anything bigger than a 1/8 in. wide keyway is not practical and even this takes a long time, also the tool will constantly move under the toolpost, upsetting the cross-slide reading.

I need to cut 1/4 in. wide keyways in H.S. steel for milling cutters and many other jobs and generally have to cut them by hand. I have designed a special slotting attachment for the Super 7, which with some modification to the tee-slot hole positions will suit the ML7 and other lathes. This attachment in conjunction with my dividing attachment (January 5) will make it quite practical to produce such things as multiple splined holes to fit spline shafts, internal gears and internal shapes and cams.

The leverage obtained is about 20-1 and there is practically no strain on the slide ways and no wear on them. The work can be carried out without moving the part from the chuck and is inherently true. The permissible static load on the thrust bearings of the headstock is of the order of 3,000 lb. so there is no need to worry on this account. The hole for the ram is bored out in position on the cross-slide, so there is no longer any excuse for " drunken " keyways.

The first thing to make is the pattern; this is quite simple. Start off with a piece of 1/2 in. plywood 6 3/4 × 4 1/16 in. and a piece of 1/8 in. ply the same size. Cut the centre out of this 4 3/8 × 1 3/4 to form a recess to relieve the bottom face and glue it on. These sizes will allow 1/16 in. on machined faces as the end facing the chuck and the operator is machined off 1/16 in. and also off the bottom face. Allowing for this fix the 7/8 in. discs which are 1/8 in. thick in position as shown. If for a different lathe, position these discs, which are for the tee bolts, so that the centre of the ram will come within 1/2 in. of the extreme " in " position of the cross-slide. This 1/2 in. is necessary when commencing to slot.

The centre pair of discs, while not strictly necessary, are to set the fixture one slot outwards for large diameter work without extending the cross-slide unduly. The rest of the pattern should require no explanation except to say that the core print for the ram should be 1 1/4 in. and about 1 in. long each end. Do not provide a core print on the operating shaft hole, as this would complicate the moulding and require a corebox. The casting will come back solid on this part, but is quite easily drilled and bored in place from the headstock of the lathe.

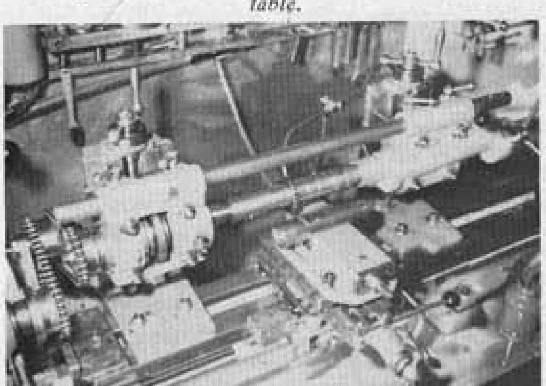
It is necessary to finish machine the ram before boring the casting as milling the rack teeth and keyway may cause a little distortion. A piece of ordinary 1 1/2 in. shafting is faced off each end to 6 in. long. A 1 in. hole for the various tools is bored in one end 2 1/2 in. long and a 3/8 in. for a draw bolt is carried right through. Make a small bevel on each end at 30 deg. I set up this steel piece on a 1 in. spigot in the chuck and supported by the tailstock centre I was able to mill the keyway which is 1/4 in. × 1/8 in. and also the rack teeth with my milling attachment (M.E., October 20). The keyway could be end milled while held on the vertical-slide and perhaps the easiest way to machine the rack teeth is in the slotter. Set a

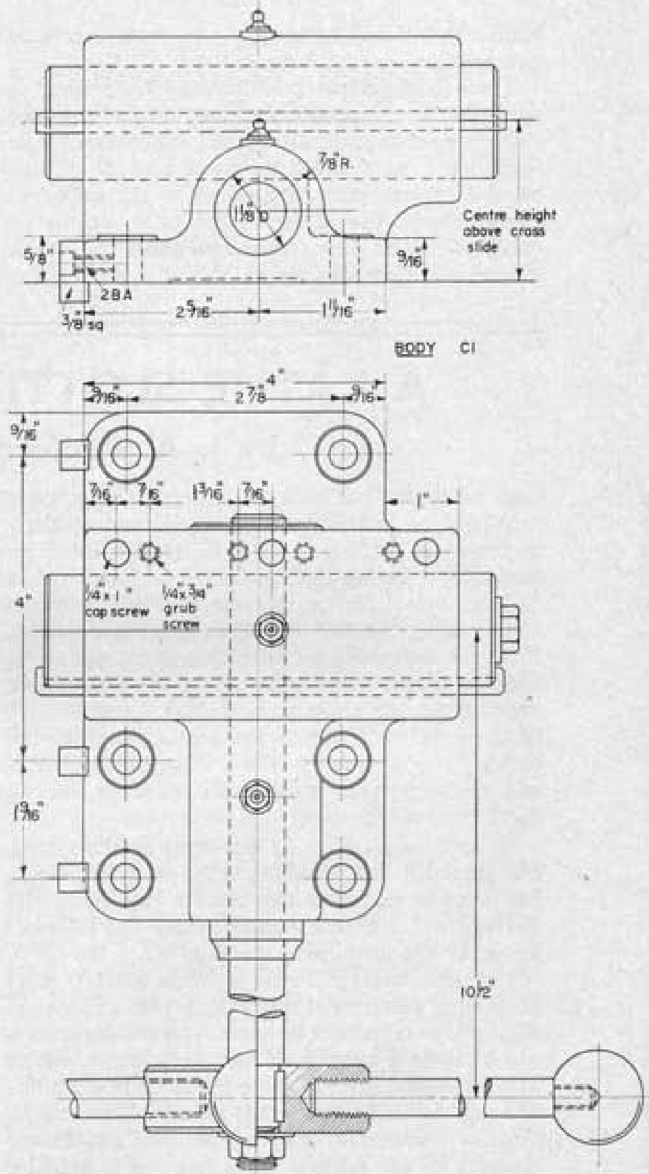
$\frac{1}{16}$ in. parting tool at $14\frac{1}{2}$ deg. angle and mill each side of the teeth and afterwards level off the bottoms of the spaces with the same tool. First however machine 1/32 in. off the diameter and then mill to a depth of 0.135 in. spacing the teeth 0.1963 in. which is the pitch of the 16 D.P. rack. The best way to do this is to use a stop clamped to the slideway of the shaper with a prepared distance piece exactly 0.1963 in. thick inserted. Clamp the stop tightly and then remove the distance piece and you have the spacing for the next tooth. The rack teeth are 4 in. long, leaving 1 in. of "plain" each end.

The key has ends bent over to prevent it working loose on its screws and also at the large hole end of the ram to form a key to hold the various slotting tools in the proper position. Merely heat the key to redness and forge over a sharp piece of steel held in the vice. The three screws to hold the key are 4 BA Allen screws sunk flush with the surface. The key and the rack are at right angles in the position as shown. Now set up the ram on a true spigot in the chuck supported by the tailstock centre and test for straightness. If at all out, take the smallest amount off the diameter to true it up. Make sure it is parallel, and polish while set up.

The casting can now be machined. First mark out and drill for the six tee slot bolts. Make sure the centre distances are correct and also that they are square with the long edge and with each other. Drill 25/64 in. Make the tee-slot bolts and bolt the casting down in its proper place, packing under each bolt so that the casting is free from rock and is level and overhangs the front edge of the cross-slide $\frac{1}{8}$ in. right along. The front edge is now faced off $\frac{1}{16}$ in. using a facing cutter if you have one of at least $4\frac{1}{2}$ in. dia. or a flycutter to sweep about $4\frac{1}{2}$ in. diameter. This edge or face is now tested and trued up by scraping to a surface plate.

Milling the rack teeth using the "Bormilathe" type elevating head. The vice is bolted to the quartering table.



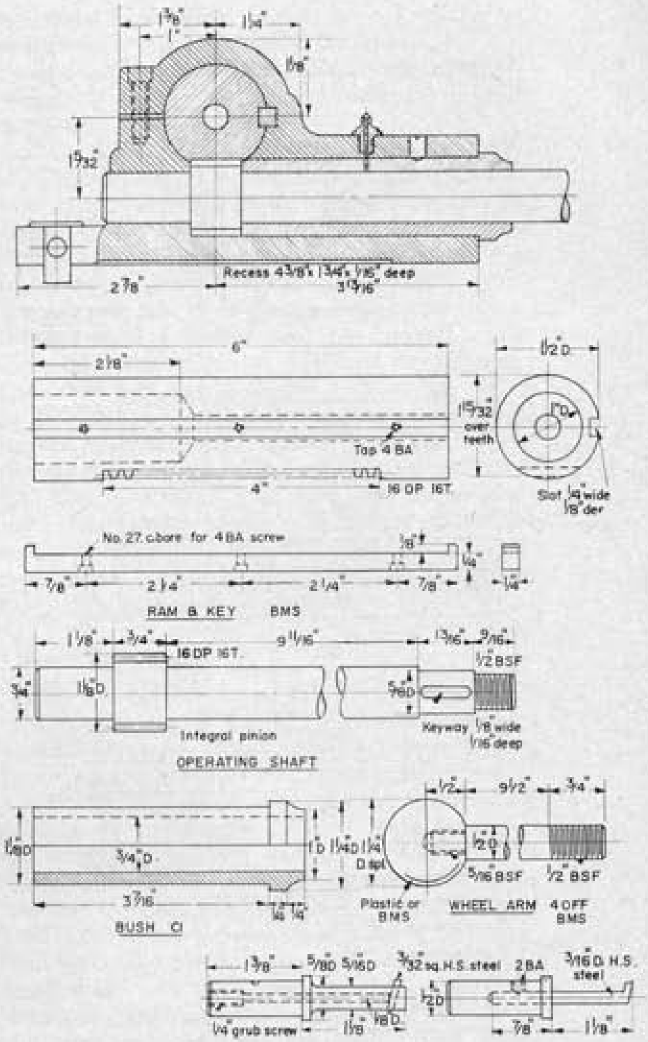


Now mount this true side face down on the cross-slide, letting the face of the base overhang the slide edge by $\frac{1}{8}$ in. Bolt with a long tee bolt through the cored hole and with two clamps. Using the same facing cutter or flycutter face off $\frac{1}{16}$ in. off the bottom, finish with a cut about 0.005 in. and then this face must be hand scraped true to the surface plate. You will appreciate the large centre recess. The three stops along the finished edge must now be fitted. They are $\frac{3}{8}$ in. key steel $\frac{7}{8}$ in. long and are set in $\frac{1}{16}$ in. and fitted with a 2 BA Allen cap screw set flush. Make sure you mill or slot these $\frac{1}{16}$ in. deep grooves all the same depth. Spot face the tee bolt holes $\frac{1}{16}$ in. off.

Next bolt the casting down on the cross-slide in its proper position for boring for the ram. The boring bar can be at least 1 in. dia. with a $\frac{1}{4}$ in. dia. H.S.S. bit. Bore to a nice push fit on the ram, allowing all spring in the boring bar to run out. Now set a $\frac{1}{8}$ in. slotting tool on its side in the bar, lock the headstock spindle, and slot the keyway $\frac{1}{8}$ in. deep. Change the tool to a $\frac{3}{16}$ in. one and reslot and finally use a $\frac{1}{4}$ in. tool. Make sure the keyway is right on the centre-line and you can be thankful that this is about the second-to-last time you will need to abuse the lathe in this manner!

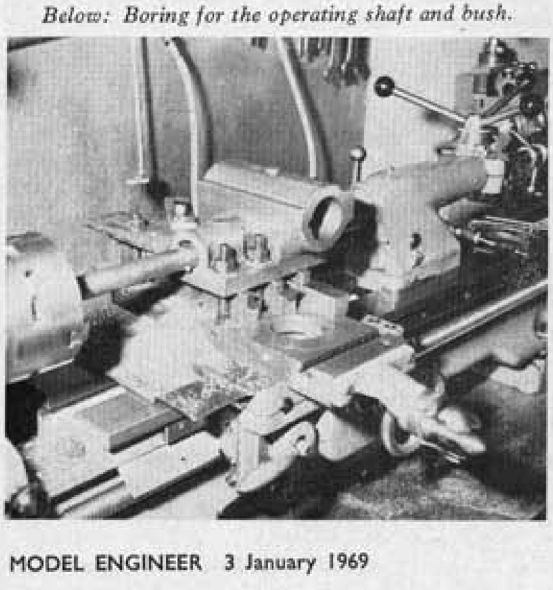
The centre distance between the ram and the operating shaft is 1 5/32 in. exactly, so the necessary packing pieces will have to be prepared of this thickness and set under the base with the casting at right angles. Allow the casting to overhang the cross-slide and after securely clamping, face off $\frac{1}{16}$ in. as before. This does not need to be checked for flatness but is now bored for the operation shaft bush. You will notice that this hole is offset $\frac{3}{16}$ in. from the centre. This is so that the operating shaft will leave the cross-slide handle index clear for reading the setting when slotting.

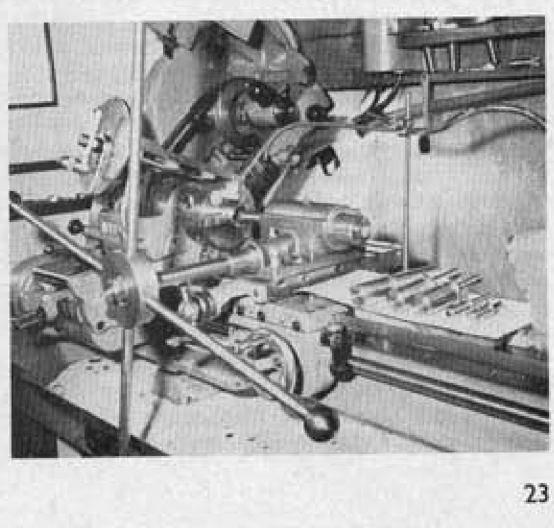
After clamping the cross-slide in position, centre drill with a large drill, and drill the size of the spigot on your drill to make a good start for the large drill. I have a 25/32 in. taper shank H.S. drill which is the largest No. 2 Morse made, and I used this in back gear to drill only to 4 in. depth, pushing along the saddle with the tailstock. This drill was followed with a $\frac{7}{8}$ in. drill right through. This hole must now be bored to 1.125 in. for a depth of $4\frac{3}{16}$ in. leaving a flat face on the end of

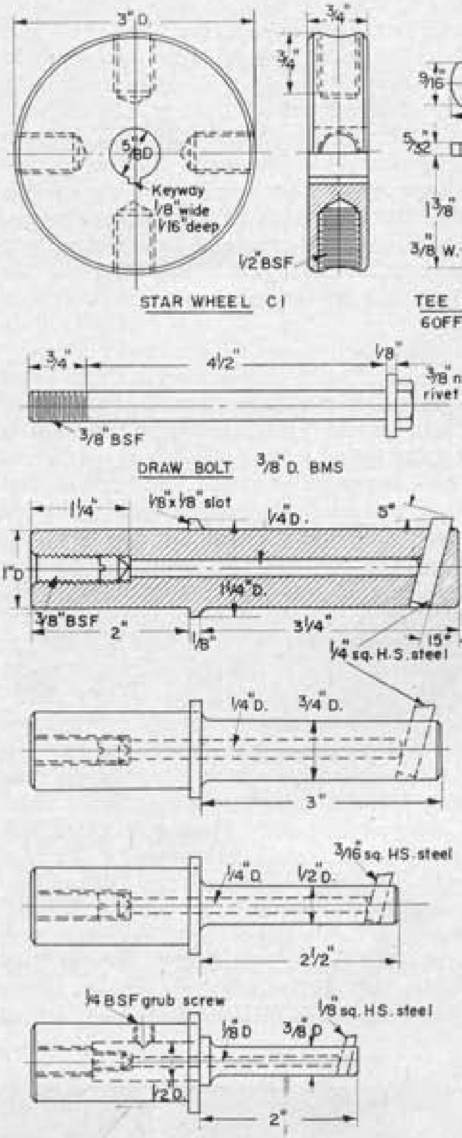


Below right: Slotting a keyway in a spacing collar.

Below: Boring for the operating shaft and bush.







the hole. To do this I first bored the 3/16 in. remainder of the hole true to 3/4 in. using a boring bar between centres. Then using a 3/4 in. dia. boring bar supported in this part and by the tailstock with the driving end held in the 3-jaw chuck, it was no problem to bore accurately to 1.125 in. or just slightly more so that the 16 D.P. pinion would slide into place.

The cast iron bush for the operating shaft should now be made. A piece of cored cast iron can be purchased from stock from most foundries, to finish turn to 1¼ in. with a ½ in. cored hole. A 6 in. length will leave sufficient to hold in the 4-jaw chuck. Centre one end with a 30 deg. tool and turn a 2 in. length true to hold securely in the 4-jaw chuck.

With this turned part held in the 4-jaw and running reasonably truly, turn to clean up, bore to clean up and face, then proceed to finish turn the outside to a nice light tap in fit in the bored hole of the casting; the length of the turned part is 3 7/16 in. The boring is now done to ¾ in. standard for a length of 4 in. A ¾ in. *machine* reamer, taper shank spiral flute, will make an easy job of sizing accurately and parallel; leave only between 0.005 in. and 0.010 in. for reaming and a very slow speed in back gear but rush the reamer straight in as fast as possible, pause a second or two and then straight out again. The result is a bore than cannot be faulted. The bush is now parted off and the other end finished somewhat after the drawing, ½ in. from the shoulder.

Star wheel hub

Before finishing with cast iron work so that the lathe can be cleaned for steel, the main casting should be slit with a 1/16 in. or 3/32 in. slitting saw 2½ in. dia. or larger, mounted on a stub arbor, and the work positioned above the saw on the vertical-slide. Feed against the direction of rotation and bring the slit right on the centre-line of the bored hole. There is one other part in cast iron still to be made and that is the star wheel hub. This could be made of steel if you have a piece of 3 in. shafting ¾ in. thick or an odd bit of cast iron can be picked up from the foundry at the same time as the bush material.

It is turned all over to 3 in. dia., faced each side to ¾ in. thick and bored and reamed to ⅝ in. and a ⅛ in. key way slotted 1/16 in. deep. This could with advantage be made 3/16 in. and 3/32 in. deep if you can manage it. Mount it on a stub mandrel and index four positions for the spokes drilling through a piece of steel held under the toolpost with a hole about 3/16 in. on the centre height. Drill into the cast iron ½ in. or so in each of the four positions, in the centre of the casting. These holes can be enlarged in the drilling machine to 7/16 in. for ½ in. BSF tapping. With advantage they could also be drilled in the lathe with the drill in the chuck and the opposite hole supported in the tailstock centre. This will ensure they are truly radial. The depth of the holes is ¾ in. and the thread is finished with a plug tap.

Operating shaft

The operating shaft can now be made. A piece of 1¼ in. shafting 13 in. long is centred each end and rough turned about 1/32 in. oversize all over, then finished as drawing. The integral pinion is 16 D.P. 16 teeth, pitch circle dia. is 1 in. and the outside dia. is 1.125 in., the depth of teeth is 0.135 in. I was able to mill the teeth and mill the feather keyway for the star wheel while still held in the chuck and on the centre, using my milling and dividing attachment. The cutter was one of my hob type cutters which the Editor has promised to describe.

I am rather at a loss to recommend how this should be done if you do not have this or similar equipment. Perhaps a separate pinion could be made or you could obtain two 14 D.P. 14 tooth pinions from Bonds and reduce the shaft on the end to ½ in. dia., fit a shallow key in the pinions and in the shaft and, leaving the shaft two or three thou. oversize, shrink the pinions on. After turning to a total of ¾ in. thickness, a sleeve of ½ in. bore and ¾ in. outside dia. and 1⅛ in. long is shrunk on against the pinions and pinned in place and finished on the outside to size. These pinions have a pitch circle dia. of 1 in., so the centre distances will be correct but the outside dia. is 1.143 in. so perhaps 0.018 in. could be turned off the outside without any harm. The rack on the ram will have to be a different pitch. The pitch of the 14 D.P. rack is 0.224 in. as against 0.1963 in. for the 16 D.P. Bond's gears are however 20 deg. pressure angle, so the tool will have to be set to this angle and not 14½ in. deg. If the pinion has been reduced in dia., the depth can be the same, namely 0.135 in. but if not the depth should be 0.154 in. and the operating shaft bush with its corresponding bored hole made to this size or slightly larger so that the shaft can be assembled.

The ⅝ in. dia. end with the keyway is made a tight fit in the star wheel hub and the ½ in. BSF thread screw-cut to fit a standard nut; a ¾ in. dia. × 3/32 in. washer is also made to fit between the nut and the hub. The ¾ in. dia. parts should be a nice free fit in the bush and on the end spigot, and polished.

Star wheel arms

Four pieces of ⅜ in. b.m.s. 10¾ in long are needed for the star wheel arms. The ⅜ in. BSF thread ⅜ in. long on one end to fit the star wheel hub should be screw-cut, as nothing looks worse than a wheel with spokes out of line. The ½ in. long thread should fit the plastic ball threads if purchased or if steel balls are made they should be 5/16 in. BSF. The steel balls should be blued in oil.

It remains now to make a set of slotting tools. I have drawn out a selection which should take care of all needs. The first three sizes, 1 in., ¾ in. and ½ in. are all made from 1¼ in. shafting, as also is the holding sleeve for the smaller sizes. There is a ¼ in. wide slot filed or milled in the ½ in. wide shoulder which locates the tool on the correct horizontal centre-line. The tools are drilled and slotted at 15 deg. angle which makes for easy cutting and the end face angle should be 5 deg. back of the horizontal; the included angle therefore is 70 deg.

If the steel end is made a little large and longer until the square holes are slotted to fit the H.S. tools, gripping tightly in the vice and marking the tools will not matter, as the tools can be finish turned and faced after slotting. Slotting is done by drilling slightly oversize, filing with a square file to get a true start for the tool, and punching through with a square tool bit, ground square across the end. Get the hole dead on the centre line. The best way to do this is to set the tool up in the fixture on the lathe, clamping it at an angle on the cross-slide, and with a small flat filed on the end of each tool, the hole can be drilled; centre drill first of course. The push rods are of silver steel and the grip screws which press against the end are ⅜ BSF ⅜ in. long. The hole in the ends of the tools to accommodate these is 1¼ in. long, as this hole also takes the draw-bolt.

Draw-bolt

The draw-bolt is threaded ⅜ BSF for a length of ¾ in. (screw-cut) and a ⅜ in. nut is fitted and riveted over on the other end; a ¾ in. dia. × 3/32 in. washer is also fitted to take the thrust.

The smaller tools which fit the sleeve are merely held in the sleeve with a ¼ in. Allen grub screw; the screw provides the pressure to hold the tool through a piece of ½ in. silver steel rod. The smallest tool is a piece of 3/16 in. round H.S. tool steel held in a socket with a 2 BA grub-screw, which fits in turn in the same sleeve as the other small tools. All the silver steel rods which hold the tools should have the ends which press against the tools rounded, and the grub-screws which provide pressure should have their points ground off flat.

To return a moment to the main casting, I find I have not mentioned a need for three 1 in. × ¼ in. Allen cap screws and the four ¾ in. Allen grub-screws which clamp and hold apart the main bore for the ram. These provide precise adjustment for the fit of the ram and can all be tightened against each other so they will not work loose. A piece of oily felt should be inserted in the slot and a 2 BA zerk nipple fitted in the centre of both this bore and the operating shaft bush. A ¼ in. Allen grub-screw holds the shaft bush in place. The tee bolts, washers and nuts need no explanation.

This completes the construction of this fixture which readers will find makes slotting a pleasure and opens up possibilities of machining which would be impossible otherwise. ▣

NIGEL GRESLEY

A new 5 in. gauge locomotive based on the old Great Northern 2-8-0 goods engines

by Martin Evans

The frame stretchers and axleboxes

Continued from page 1172

BEFORE LEAVING the buffer and drag beams, there are two 8 BA tapped holes to be put in, to the left of the coupling slot, in the buffer beam only. These are to take a little clip, to support the vacuum brake pipe. It is always easier to put such holes in before assembly.

To fix the frames to the buffer and drag beams. 4 BA steel screws about ⅝ in. long are required, They may be cheesehead, roundhead, Allen cap type or hexagon head. I prefer hexagon, although cheeseheads are the easiest to fit, and Allen are much the strongest. Make a trial assembly, nutting the screws on the inside, and if all is well, the frames can be dismantled again for fitting the main horns.

The horns are similar to those used on *Springbok* and may be gunmetal or iron castings. Before attempting to machine them, go over all the surfaces that need machining with an old file, to remove the sand and scale. File the outside faces and rub on some medium-grade emery laid on something flat, then work from these faces. Set up the vertical-slide facing the lathe headstock, making certain that it is quite square by first bringing it hard up against the faceplate.

Each horn can now be held hard against the vertical-slide by a piece of steel bar about 1 in. × ¼ in. section across the gap and a ¼ in. dia. Allen screw put into a T-nut in the slide. An end-mill about ½ in. dia. can be mounted in a collet or the 3-jaw chuck, and this can be worked all round the bolting flanges, the saddle being locked to the bed, and the cross-slide and vertical-slide tranversed against the rotation of the end-mill.

The two horns for the trailing axle have to be reduced in height to clear the firebox, so cut these across as shown, 2¼ in. from the base. Drill the horns as in the drawing, page 1171, for 3/32 in. dia. rivets. A ⅛ in. dia. hole should also be drilled in each horn, 11/32 in. from the centre, for the oil pipe. The horns should be fitted individually to the frames, and should be reasonably tight before drilling through into the frames for the rivets. Soft iron snaphead rivets are used, hammered into countersinks on the outsides of the frames and then filed flush.

Frame stretchers

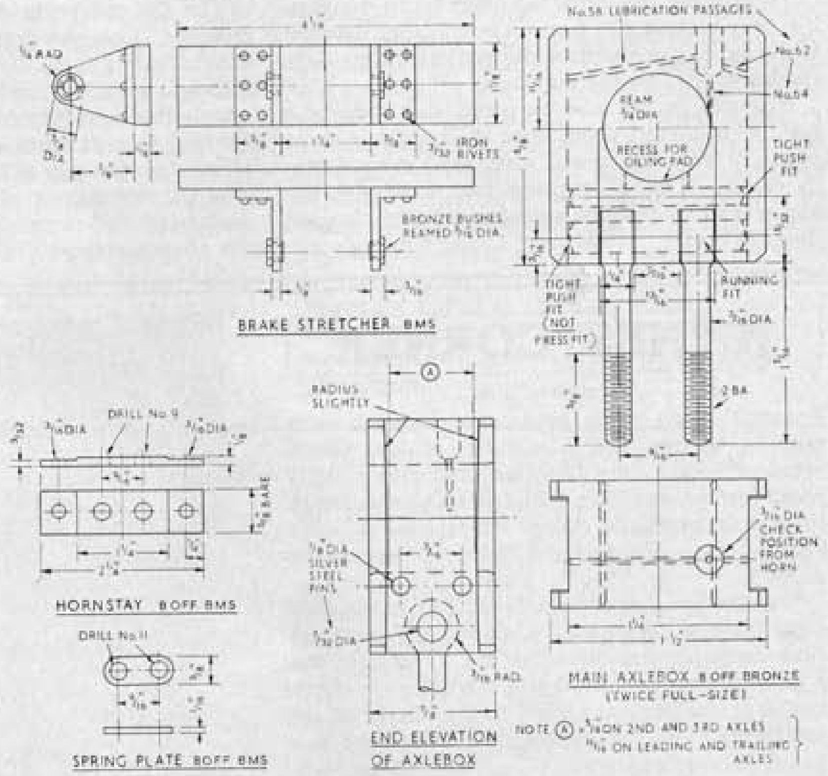
Returning now to the frame stretchers, most of these can be cut from ⅛ in. steel plate, though I understand that some of our regular advertisers may be supplying castings, which will save a lot of work.

The pony truck stretcher and the pony truck pivot stretcher are both cut from 1 in. × ⅜ in. b.m.s. bar. The former requires a ⅝ in. dia. hole exactly in the centre, and this should be bored and reamed. The latter has a 5/16 in. dia. hole reamed in its centre.

No. 3 main stretcher, which is arranged vertically, is cut from ⅛ in. b.m.s. plate, and is secured to the frames by ½ in. × ½ in. × ⅛ in. steel angles. These stretchers were illustrated on page 1171, and here

2-8-0 No. 461 was Gresley's first three-cylinder locomotive. All the cylinders were steeply inclined.

Details of the brake stretcher, main axleboxes and hornstays.



is the drawing of the final one, the brake stretcher, which is made from ⅛ in. b.m.s. plate and 1¼ in. steel angle. The two angle pieces carry phosphor-bronze bushes reamed $\frac{3}{16}$ in. dia. for the brake shaft.

We may as well make the hornstays next; these are cut from ⅝ in. × ⅛ in. b.m.s., or the nearest wider. After cutting to length, the pieces are milled across at each end to a depth of 1/32 in. to form "steps," and the centre part, of the full ⅛ in. thickness, should be a close fit in the gaps of the horns. The spring plates are very simple; they are cut from ⅝ in. by $\frac{1}{16}$ in. b.m.s. strip.

Axleboxes

Nigel Gresley's axleboxes are of the proper split type, with pivoted spring pins, and should help to give the engine the maximum grip on the rails. Builders should note a small but important variation from previous designs; in order to allow a little extra flexibility on curves, the leading and trailing axleboxes are slotted out to a width of $\frac{11}{16}$ in. between flanges, as against ⅝ in. for the second and driving axleboxes. This is in addition to the radiusing of the insides of the flanges, which allows the axleboxes to rock a little, when the engine is going over a rough patch.

There are many ways of machining axleboxes. One sound method is to bore and ream (do not try to drill them), to finished size and work from the bore. But first one side of each of the eight axleboxes should be finish-machined, either by milling or by facing in the lathe, using the 4-jaw chuck. Centre-drill, bore and ream while still in the chuck.

Off-side view of the standard G.N.R. two-cylinder 2-8-0.

To machine the other face, parallel to the first, it is only necessary to turn up a little stub mandrel in the lathe, a push-fit for the axleboxes (just tight enough to hold by friction alone).

A simple jig can now be made, consisting of a plate of mid steel about $\frac{3}{8}$ in. thick, with a short length of $\frac{3}{8}$ in. dia. round silver steel pressed into its centre. This is furnished with a suitable nut and washer so that the axleboxes can be clamped down in turn.

The jig can be held to the saddle by several methods. One way is to clamp it straight down to the cross-slide (with the top-slide removed) placing sufficient packing under the plate to bring it exactly to lathe centre height. The sides and working faces can then be machined by an end-mill of suitable diameter in a collet or the 3-jaw chuck; after the first side of all eight axleboxes have been dealt with, the clamping nut is slackened off, and the axlebox rotated through 180 deg., to complete.

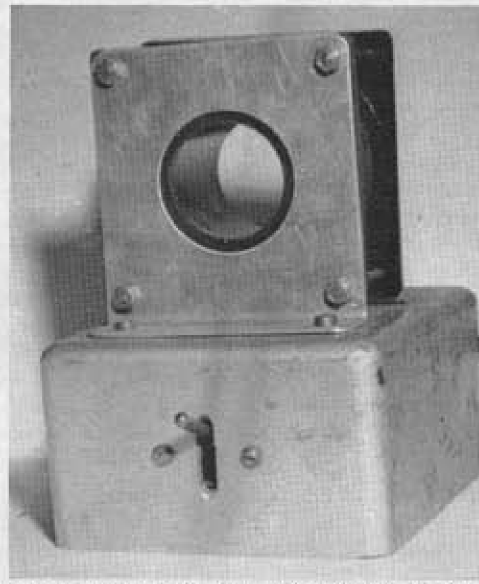
JEYNES' CORNER

Workshop aids

POSSIBLY many small lathe users have at some time or another, had a quantity of jobs which required both a very fine feed, and also a fairly coarse thread and have found it quite a nuisance to keep on having to change the wheels. I had a heap of such jobs, and decided to do something about it.

I made a rough eccentric, bored $\frac{3}{8}$ in. and drilled a driving-peg hole $\frac{1}{8}$ in. dia. to suit the quadrant stud, and other gear wheels in use. The strap was a piece of aluminium rod $\frac{1}{8}$ in. dia., bent at right-angles at the end, and filed to the shape of the gear teeth. As the pitch of the oil-groove was steep, only quite a small wheel was on the lead-screw, while the ratchet effect provided a reasonably fine feed; to change, all that was necessary was to slacken the quadrant, and move the lead-screw gear out of mesh, then drop the tooth end of the strap on to the wheel so that each stroke of the eccentric pushed the lead-screw a couple of teeth or so. The friction of the lead-screw bearings, saddle, etc., did not appear to cause any wear on the teeth, while it was enough to prevent the wheel returning with the ratchet. I found it was actually possible to reverse the action by moving the strap-tooth forward or backward from the vertical centre-line of the gear-wheel on the lead-screw, and I later found this very useful in rewinding high-resistance relay coils with 40 gauge wire, as failure, in previous service, of the coils, which had been

A ratchet feed, providing a fine feed for the saddle without changing wheels.



A de-magnetiser built from the contents of the junk box, a most useful adjunct to the workshop.

hand guided, was proved to have been caused by the acid in the perspiration from the winder's hand.

Another workshop headache was the magnetising of drills, reamers, etc., I think there is nothing more annoying than swarf balling up under the drill-point, especially on cast iron where no lubricant is used and the friction will soon turn the drill-point blue, while in reaming a small cylinder bore scoring often takes place. I suffered quite a lot in this direction, owing to proximity of magnetic chucks, tables, etc. Testing these on the bench I found had a marked effect on hardened steel tools in the tray of the drawers of the bench.

Eventually therefore, I build myself a " Heath Robinson " de-magnetiser from junk lying about. The coil was an old Allan West contactor coil wound for 110 volts, so required a ballast resistance to use on 240 volts. It was mounted between two sheet alloy cheeks on top of an old DOL motor-starter alloy case and the original conduit entry used to accommodate a gland for the flex entry;

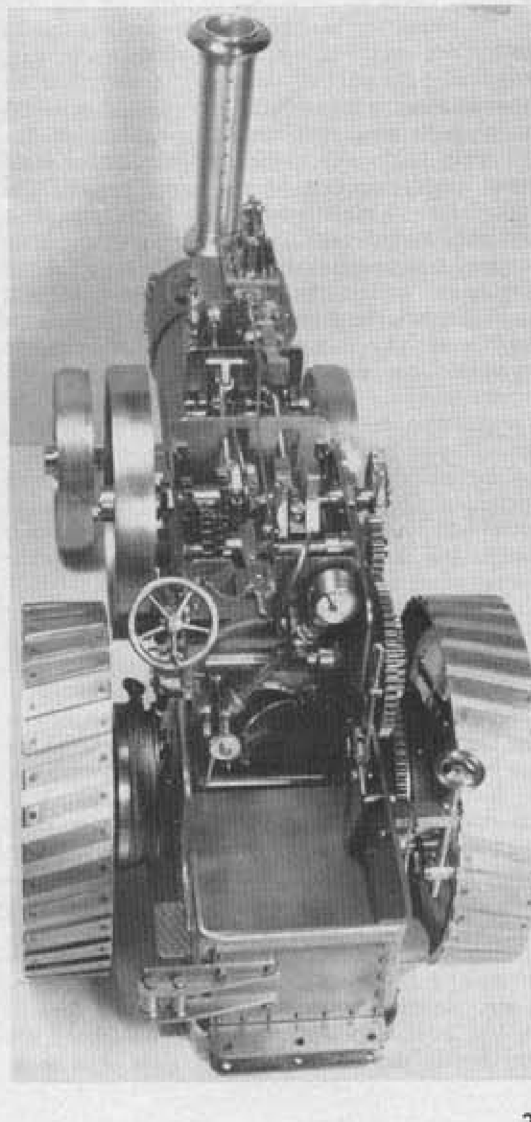
a slot was cut in the other end for the handle of a 15 amp double-pole foot-switch from an old heater.

In use if the coil was left on, it heated up, owing to the absence of the choking effect of the laminated iron core it was originally designed to draw into itself. To use, I switch on, and slowly pass the magnetised drill, etc., through the centre of the coil-bore opening, and slowly withdraw it until out of the magnetic field of the coil. To magnetise an article, I just place it in the centre of the coil-bore, and switch on and off keeping the article still. Memo: keep your watch well away from these operations.

While working on a test-bench, rigged for a.c. and d.c., I accidently threw over a change-over switch while testing a small a.c. motor—in fact I changed over from a.c. to d.c. while the motor was running. I was startled by the rapidity of its stoppage on application of d.c. to the windings, but on examining the motor no ill effects were apparent. I repeated the action with no other effect than that the motor windings warmed up owing to the choke effect on a.c. being absent. The chief engineer expressed interest, and there the matter ended. Later I read an article in an American magazine on d.c. injection into a.c. motor circuits to effect braking which caused me some amusement, coming so long after my own experiments.

THE NEW MODEL ENGINEER TRACTION ENGINE

Continued from page 13



Right: Driver's view of the new traction engine.

gunmetal casting for a small component, when it can be cleanly made up from steel pieces to require no machining—and when the real thing is steel anyway! Fabricating small items from stock oddments can obviously be much cheaper, too.

Should anyone already be sufficiently interested to start assessing material costs before Part II (details of the boiler building) appears, the complete boiler needs:

Seamless copper tube:
- 9 in. of 2$\frac{1}{2}$ in. O/D × 16 s.w.g.
  (This includes the smokebox)
- 9 lengths, 6 in. full long × $\frac{3}{8}$ in. O/D × 22 s.w.g.
- $\frac{3}{4}$ in. of 1 $\frac{1}{16}$ in. O/D × $\frac{1}{8}$ in. wall.

Sheet:
- 12 in. × 12 in. × 16 s.w.g. (or $\frac{1}{16}$ in.)
- 6 in. × 9 in. × 13 s.w.g. (or 3/32 in.).

12 in. of $\frac{1}{4}$ in. square copper rod.

One last little point; if this is your first traction engine model, and all your previous modelling has been with things like boats, aircraft or cars, you will probably be a little apprehensive at the way the weight mounts up. You need not be. Given reasonable workmanship in building, the limiting factor in a model traction engine's performance is nearly always rear wheel adhesion. So if it looks reasonably right and to scale it will not be too heavy.

To be continued.

TWO 5 in. GAUGE "PUSH & PULL" LOCOMOTIVES

Described by D. Young

The cab layout for No. 2

continued from page 1234

TO LOCATE the mechanical lubricator drive link on the cross tie, a collar, made from 3/16 in. steel rod, is fitted on each side of the link. Collar-fixing can be done by taper-pin or grub-screw.

Turning our attention to the boiler handrails, first turn up the handrail knobs and fit the three short-pattern ones to the smokebox, in the holes already provided. It is an advantage to make the handrail in one piece, for by removing the front handrail knob it can readily be withdrawn. Take a 2 ft. 3 in. length of 1/8 in. mild or stainless steel rod, feed the front knob onto it and bend into place, to give the front profile as shown. Feed through the smokebox wing knobs and check that the handrails are parallel with the top of the boiler barrel. The boiler handrail knob supports are from brass strip and rod, brazed together. Assemble to the long pattern knobs and slide them along the boiler barrel. The knobs are positioned 3/4 in. in front of, and 2 1/8 in. behind, the dome centre-line. Spot through the No. 44 holes in the supports, drill through the barrel No. 51 and tap 8 BA, before fixing with bronze screws. Use jointing compound on the threads, then there will be no danger of steam leakage. If you have sufficient faith in your boiler-making ability, these supports can be made from copper or phospher-bronze rod, spigoted into the barrel and brazed in at the same time as the dome flange. But don't blame me if they finish up in the wrong position !

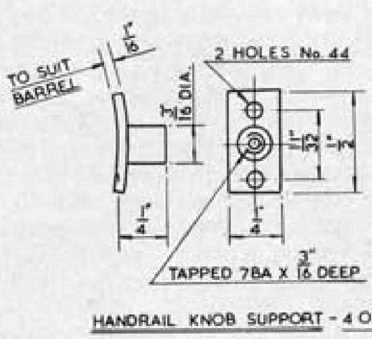
To finish off the handrail, cut to length at the ends, drill into them (say No. 46) for 3/32 in. depth and make up a pair of headed plugs a light drill fit in the drilled ends.

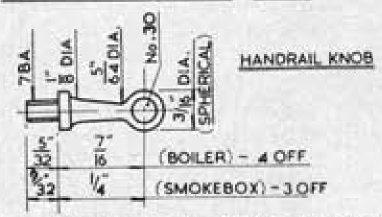
No. 1 builders should now be rapidly approaching the first steam test so will be left to peruse the cab layout while further progress is made with No. 2. We can pick up the description for No. 2 at the same point: cab layout. There is very little work to be done here, for the moment, as the boiler mountings have already been dealt with. The firehole door assembly is the outstanding item, being common to Nos. 1 and 2. For the firehole door, centrepop a piece of 16 s.w.g. brass sheet, scribe circles of 7/8 in. × 3/4 in. radius and saw out roughly to the outside profile. Trim with a file then drill the No. 41 hole through the centre. Chuck a 7 BA steel nut in the three-jaw and bolt the door to it. Take light skims to reduce the outside diameter to size. Remove, mark off and drill the remaining No. 41 holes and remove all burrs. The baffle is a smaller version of the door, made in the same manner. Make the baffle spacer from 3/16 in. brass rod then bolt the three pieces temporarily together.

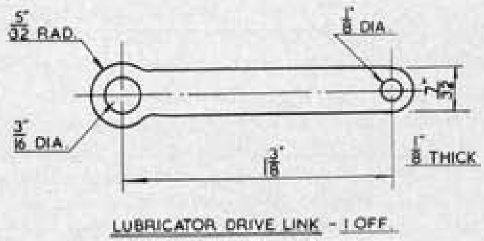
The hinge block comes next: chuck the 3/16 in. brass rod again, face, centre, drill No. 41 for 3/16 in. depth and part off a 1/2 in. length. Lay it on a piece of 1/8 in. thick brass strip and braze together. Trim up the strip to the sizes given and drill the two No. 41 fixing holes. The pair of hinges are made in exactly the same manner, after which the hinge pin can be turned up from the 3/16 in. rod.

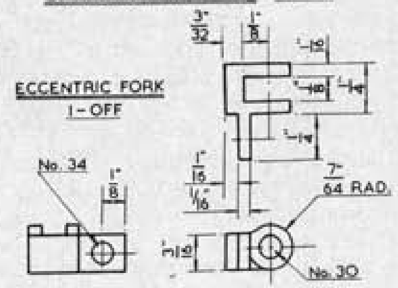
Scribe the horizontal centre-line on the firehole door, as per drawing. It is important to get this line correct, to save the fittings fouling the three air-holes. Hold the door centrally about the firehole ring and offer up the hinge assembly to it. Space the hinges equally about the door centre-line, then spot through the No. 41 holes in the block. Drill the boiler backhead No. 48, and carefully tap 7 BA. Fit the hinge block with temporary screws. Spot through one of the No. 51 holes in the top hinge, drill through the door and fix it with a 10 BA bolt. Check that the door shuts without the baffle fouling, then drill the three holes remaining. Remove the baffle and fit four brass or copper rivets to secure the hinges.

Next check that the door seats reasonably well on the firehole ring. Adjust the face of the hinge block, if necessary. Turn up four 7 BA screws from phosphor-bronze rod and secure the hinge block with two of them, anointing the threads with jointing compound. Put a 3/32 in. × 3/8 in. long snaphead rivet in the door centre-hole then make and clamp the catch to the door, just clear of the rivet-head. Drill through and rivet the catch to the door. Fit the baffle and spacer over the centre rivet and peen it over the baffle plate. Lastly, the catch spring which is best made from stainless steel strip. First drill the fixing holes, then bend to the shape shown. Assemble the door, leaving it ajar and, holding the catch spring in place, spot through the No. 41 holes. Drill and tap one hole through the backhead and bolt on the spring. If you now try the action of the door, it should snap shut without undue pressure. When satisfied, drill and tap







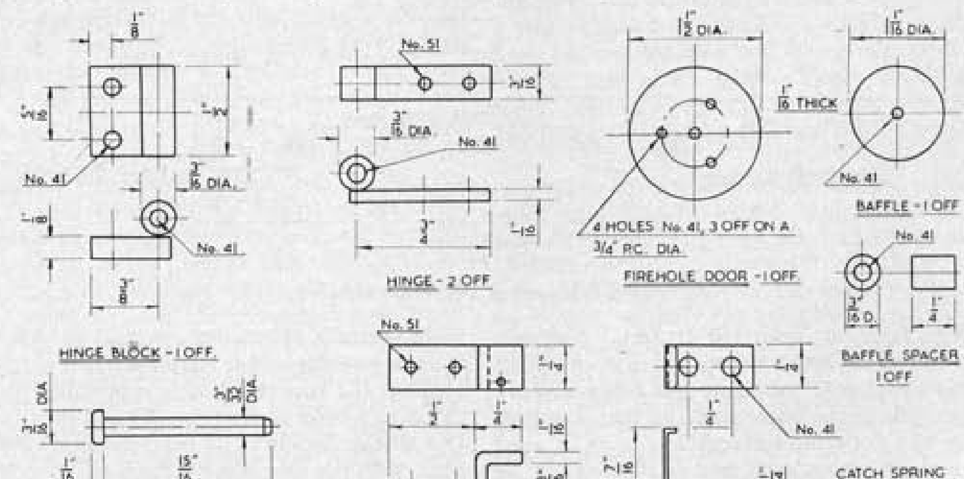


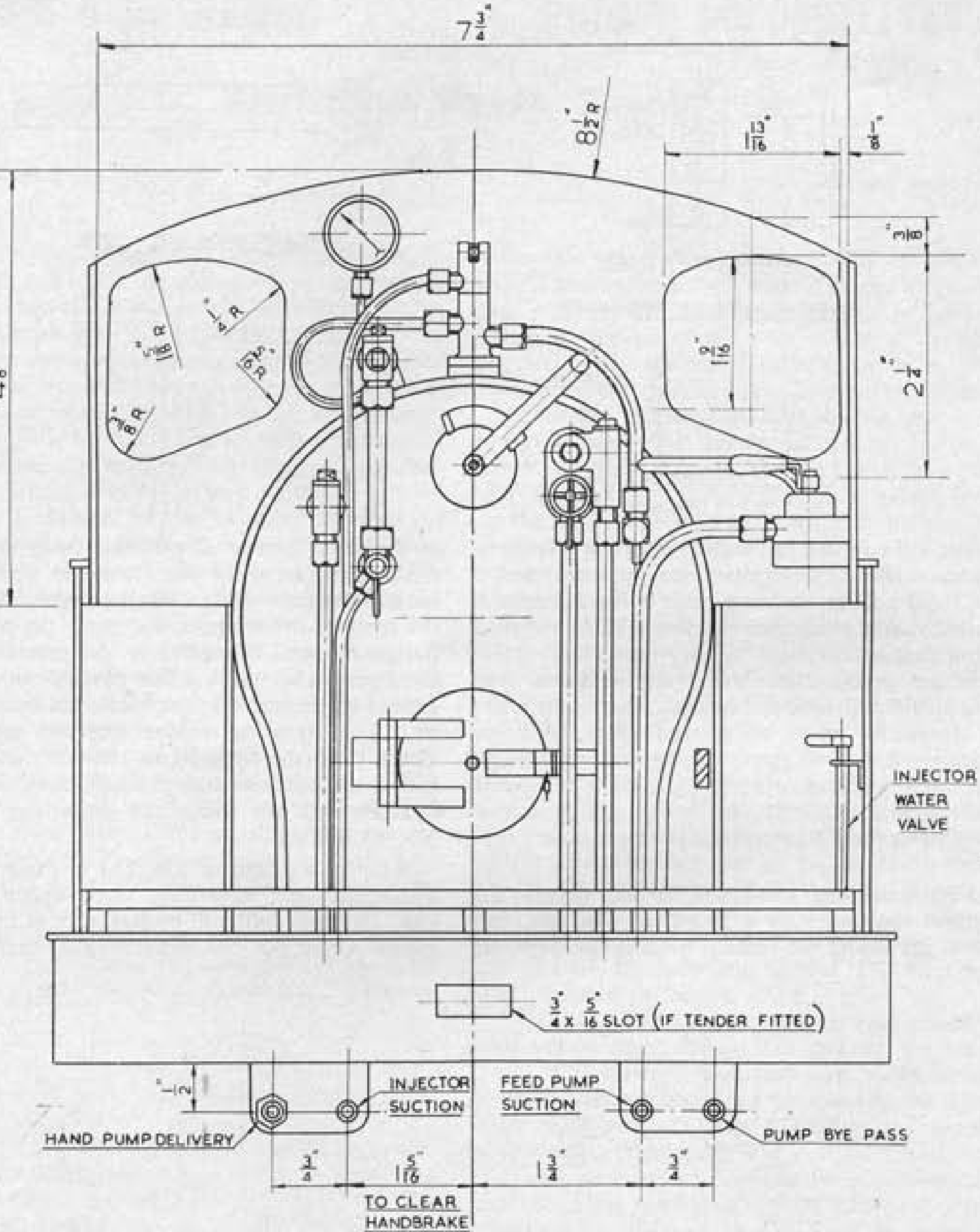
the second hole and fit the two remaining phosphor-bronze screws. One feature not yet mentioned is the third hole in the catch, this is for a length of chain to assist in opening the door without suffering burnt fingers.

Before erecting the boiler, the radiation (and ash) shield will have to be fitted. Cut to the shape as shown, in 16-20 s.w.g. steel sheet. Drill the three top holes and cramp to the front face of the rear horns stretcher. Spot through these holes, drill No. 39 to ¼ in. depth, tap 5 BA and fit screws. Drill holes through the shield from the inner horn-stay.

Next erect the smokebox in the frames and support the boiler by a length of ⅞ in. dia. bar, across the top of the frames, holding the back end of the boiler barrel. It will now be apparent why the front edges of the outer wrapper were not cut back to the throatplate. Put a straight edge across the front of the wrapper and mark the top of the frames in line. Transfer to the outside face of the frames and scribe a line parallel with the top edge, ⅜ in. distant. On the horizontal line, measure back ⅛ in. from the vertical line and centre-pop. Check from the large frame cut-out that the pop marks are opposite one another, then drill from each through the frame and projecting wrapper, No. 30 initially.

Now try a length of ⅛ in. rod to check both for squareness, and also that, when opened out to ¼ in. dia. there will still be clearance at the throat-plate. Open out the holes to ¼ in. then remove





The cab layout of No. 1 locomotive.

the boiler assembly from the frames. Elongate the two frame holes backwards by ⅛ in. to allow for boiler expansion. Make up the boiler support rod from ¼ in. b.m.s. bar, checking that it moves freely in the elongated frame holes.

The ashpan comes next and is marked out in the flat on a sheet of 16 s.w.g. steel, overall size about 6½ in. × 5¼ in. Measure the firebox width with calipers and space this dimension, on the sheet, equally about the centre-line. At 3 9/16 in. from one of the longer edges, scribe a parallel line. Cut out the two redundant, approximately square pieces and bend up first the end and then the sides. Use the scribed lines as bend-lines, keeping them flush with the vice jaws. Check on the job before brazing up the two corner seams.

For the grate the first requirement is a lot of ¼ in. × ⅛ in. b.m.s. strip. Cut nine pieces to 3 5/16 in.

length and two pieces to 2 5/16 in. Mark off, on one of the longer pieces, the hole-centres for the two supporting rods. Drill through and use as a template for the remaining bars. Chuck a length of 1/4 in. steel bar, face, centre and drill No. 30, to say 3/4 in. depth, before parting off a 5/32 in. slice. Get this latter dimension fairly accurate as the accumulative tolerance over ten spacers can be an eye opener, besides the fact of the grate not fitting inside the firebox. Sixteen spacers in all are required. Next make up the four supports from 1/4 in. × 1/8 in., or 5/32 in. strip (the latter will provide a better airspace). Grip a full 3 in. length of 1/8 in. steel rod in the vice, the upper end being just above the jaws, and peen over to form a rivet head. Repeat with a similar length, then assemble all the pieces made over these rods. Now rivet over the other end of the rods so that the whole is clamped tightly together. Adjust the four legs until they sit flat on the ashpan bottom; then insert the grate into the bottom of the firebox. Hold the ashpan up to the legs and clamp the back pair to the ashpan. Check that the assembly is easily removable from the firebox, shorten any firebar that prevents this. Remove and drill No. 30 through the ashpan into the legs, and secure with 1/8 in. iron rivets.

Mark off and drill the No. 30 hole in each frame, as shown below the large cut-out. Erect the boiler again, using the support rod this time, and offer up the ashpan to the firebox. Drill No. 30 through the ashpan from the frame holes; then fabricate the ashpan dumping pin from 1/8 in. and 1/4 in. steel rod before fitting. There used to be a craze for knurling the head of the dumping pin. I received knurled finger-ends on one occasion, so use pliers to remove the pin after a run. The boiler can now be left in situ until after the first "steam-up," so put nuts on either end of the support rod. Screw in the blow-down valves at this stage—then they will not be forgotten.

Front and side running boards come next, the front piece being left loose, for ease of access to the lubricator. Make up a lamp iron, as detailed for No. 1, and bolt it to the middle of the front buffer beam face. To give it a neat fit, cut a recess in the running board, then it will not fall off in service. The side pieces are made simply from steel or brass strip, secured to the valance and front buffer beam by screws, as for No. 1.

Now we can deal with the side tanks. The right-hand tank incorporates a coal space and is also narrower to provide clearance for the reach rod. Both should be made from 16-18 s.w.g. brass sheet—rather expensive I know, but it does not rust. Start with the bottoms which are both 12 3/4 in. × 2 7/16 in. overall. Mark off the cut-outs, approximately 1 5/8 in. × 1 in., to clear the lifting arms and links. Try them in place, to check that there is sufficient clearance. Mark out the remaining holes, but leave them undrilled for the moment.

All four sides are 11 13/16 in. × 3 3/4 in. overall. From the tank bottoms, mark out the weighshaft cut-outs on the inside pair, then attach them, using lengths of 1/2 in. × 1/2 in. × 1/16 in. brass angle. 1/16 in. copper rivets, 8 BA countersunk screws, or a mixture of both are used to assemble the various pieces together. Avoid over-enthusiasm when knocking over the rivets; otherwise the holes will distort with ugly results. Countersink the outside face of the plates and file flush after riveting or the heads will show up badly when painted.

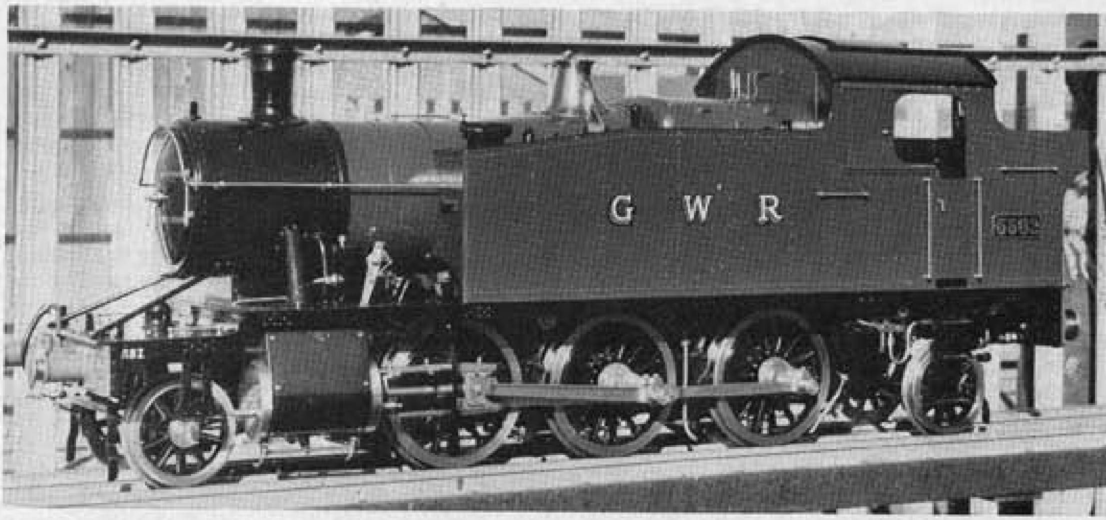
Concentrating on the right-hand tank, cut out a plain partition 3 3/4 in. × 1 3/4 in., for the front of the coal space and another piece of equal size with a "shovel opening" for the rear. Fix these with pieces of angle to the tank side already assembled and to the tank bottom. Next, make up and fit the little box over the cut-out for the motion. This can be bent up as one piece or made from three separate pieces as shown, the width being 1 3/4 in., as for the coal space plates. Final shaping of the front plate will have to be left until the boiler is lagged, so cut initially to 3 3/4 in. × 2 5/8 in. Fasten the outer tank side plate, then offer up to the pieces already assembled and fix with further pieces of angle. At 1/4 in. below the top edge of the tank, fit angle right the way round (screws are best for this), as a sill for the tank top to sit on. Fit a short stub of 3/8 in. copper tube, as shown, on the inner side; this will be used later on to connect the tanks.

Brush some Baker's soldering fluid around all the joints and carefully heat the tank all over with a small blowlamp. Feed in a stick of solder, and keep turning the tank with pliers until the solder has run into all the joints. Check by filling with water, holding a finger over the stub pipe end. If water-tight, scrub the tank out with warm, soapy water.

The left-hand tank is much simpler and should cause no difficulty. Do not forget the union connection on the stub-pipe for feed-pump suction. Use the template, retained from the boiler test, to drill the fixing holes for the hand pump in the front plate of the right-hand tank. Smear liquid jointing compound across the pump face before bolting it to the tank.

The right-hand tank top should be made a good fit in its recess and may be attached with six 8 BA countersunk brass screws, if desired. The left-hand tank top is made in two sections so that it can be lifted without disturbing the spectacle plate.

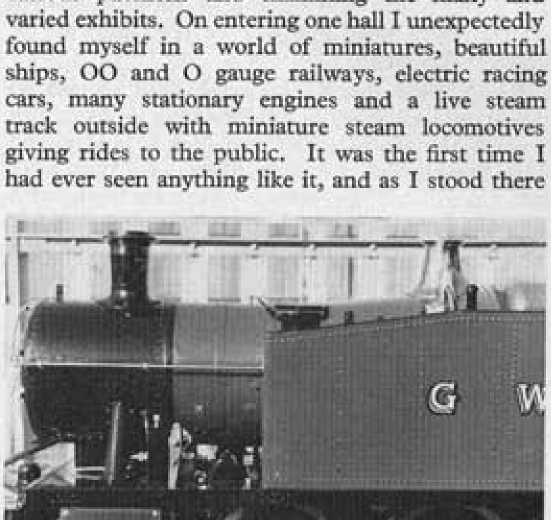
To be continued.



SOUTH AFRICAN "FIREFLY"

built by N. Popich

EASTER TIME 1960 saw me wandering around the Rand Easter Show, Johannesburg, visiting the various pavilions and examining the many and varied exhibits. On entering one hall I unexpectedly found myself in a world of miniatures, beautiful ships, OO and O gauge railways, electric racing cars, many stationary engines and a live steam track outside with miniature steam locomotives giving rides to the public. It was the first time I had ever seen anything like it, and as I stood there admiring the skill and patience of the builders and their fine craftsmanship, I decided that this was the hobby for me—the bug had bitten—and I was lost.



Looking around for somebody to talk to about it, I was lucky in meeting Dick Tuchton, one of the oldest members of the Rand Society of Model Engineers, and through him I was able to get in contact with Henry Heyl of West Turffontein, Johannesburg. Henry at that time was running a small model supplies business and I was able to purchase some Stuart Turner castings from him. Metaphorically clutching them to my breast, I returned to Pretoria and started work.

Workshop equipment

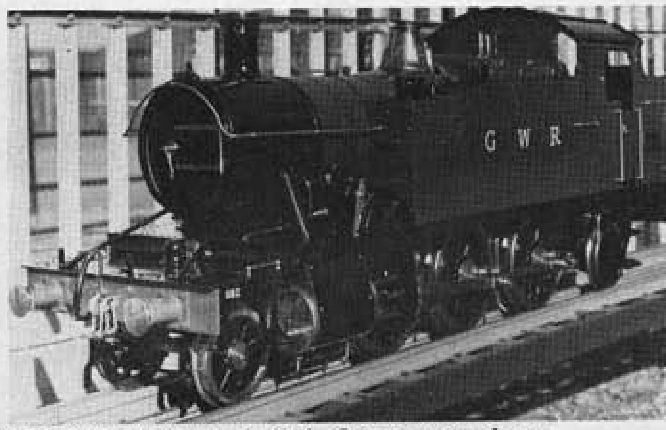
My workshop equipment at that time consisted of a 7 in. Osborne lathe made by Colchester about fifty years old but in good condition, a home made drilling machine and a small bench grinder, plus many hand tools, and using these I eventually completed the Stuart engines.

Having trained as a motor fitter, I had some idea of the machining problems involved, but the building of these stationary engines gave me a sound basic training in the construction of models without which I could never have tackled *Firefly*. I entered the Stuart engines in one of the Hobbies

Fairs held at Pretoria and was gratified and surprised to receive a gold medal.

At this time Henry was building a *Firefly* and I decided that I wanted to build one too. The drawings were obtained from *Model Engineer* and they just about scared the daylights out of me but I studied them carefully and eventually made a start. Naturally I ran into trouble at various times, but a quick trip over to Johannesburg to see Henry Heyl got me over the hurdles. Without Henry's advice and help I probably would not have been able to complete the job, and I would like to convey to him my sincere thanks for his patience and the time he gave up to help me.

The machining of the various parts proved to be comparatively simple once I got the hang of it, but difficulty was experienced in obtaining the small BA nuts and bolts and these were all made on my old lathe from hexagon bar. I worked to the drawings in every respect and all the motion and rods were made from stainless steel. I experienced no difficulty in following the designs which are a credit to Mr Martin Evans; work on *Firefly* was started in 1962 and was completed in 1967. I was scared to steam her up and run her at first, but once again Henry came to my rescue, and got her going. There was not a single snag and the engine steamed and ran like a thoroughbred. After a few more runs on the Johannesburg Live Steam Club's track, she was stripped down and painted, all the parts being first sandblasted to clean them and provide a good "key" for the paint. This consisted of one coat of Zinc Chromate primer, one coat of undercoating and three coats of heat-resisting synthetic enamel sprayed on.



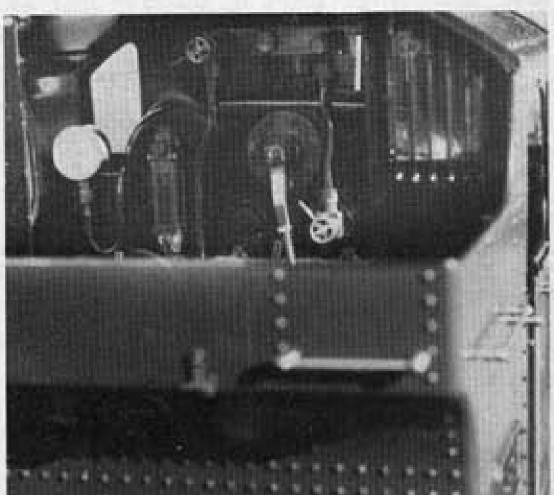
This "Firefly" was built in five years, and was awarded a Gold Medal at the Rand Easter Show, 1968.

Various small details on the engine were obtained from photographs from British Railways.

Firefly was entered in the competition section of the R.S.M.E. exhibition of the Rand Easter show 1968 and I was one of the recipients of that club's gold medal. While I am most pleased and proud of this award, I feel that some of the credit should go to Mr Martin Evans who designed the engine and to Henry Heyl who gave me unstinted help and encouragement.

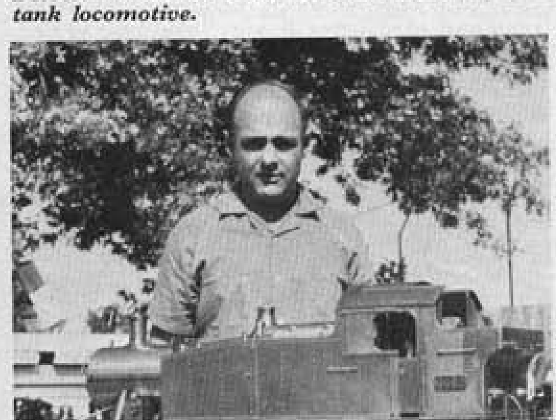
At the moment work is in progress on a *Springbok* of which the chassis is complete, and if it comes up to the same standard as *Firefly* I shall be more than happy that I chose live steam as a hobby. I would be lost without it.

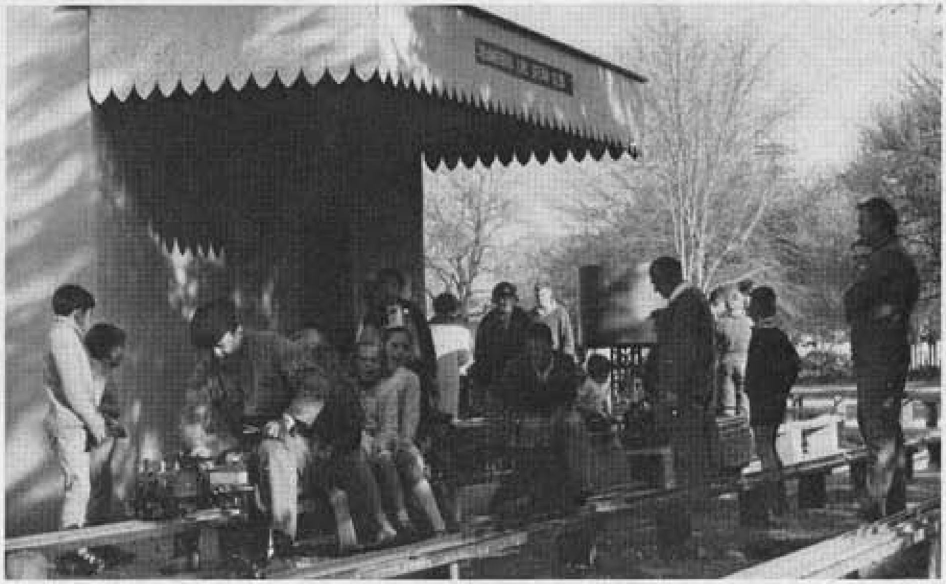
See also next page



Below left: A view of the cab fittings.

Below: The author with his Great Western 2-6-2 tank locomotive.





Some of the members of the Johannesburg Society with their engines: Garth Gradwell's "Juliet," Brian Armstrong's "Springbok" and Nick Popich's "Firefly"

L.N.W.R. "GEORGE THE FIFTH"

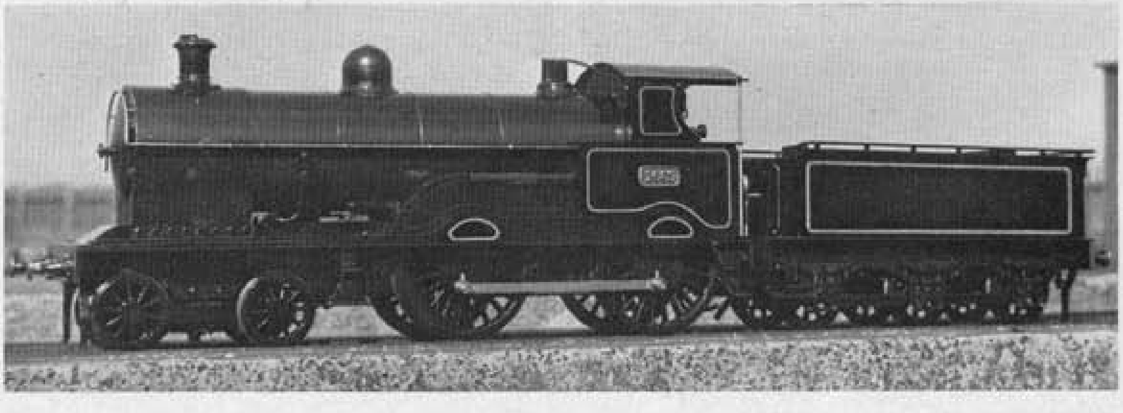
by Max Lewitt

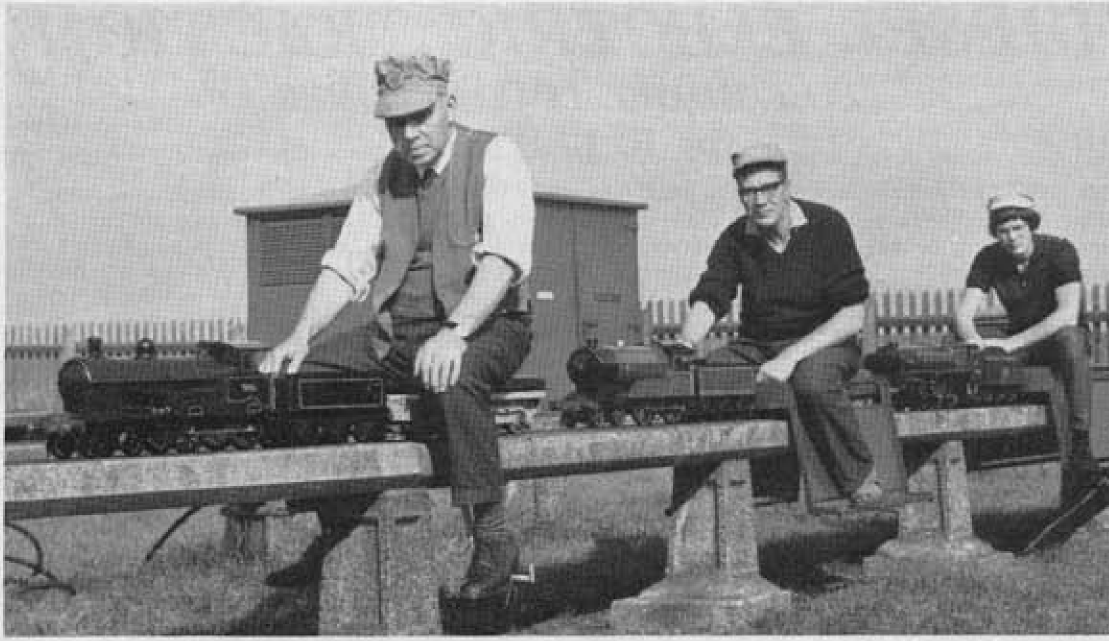
THE GERM OF THE IDEA of this locomotive was planted years ago, long before any thought had been given to its building. The explanation of how and why the building did eventually take place is given herewith.

Some years ago and subsequent to the M.E. Exhibition for that year, the late J. N. Maskelyne in his critical survey of the exhibits gave high praise to a G.N. chimney, stating—as far as the writer can recall—that it was "the most perfect example of a model locomotive chimney he had ever seen." The article was accompanied by a photograph of the chimney.

Now the writer, being a L.N.W. fan, was never impressed by a G.N. chimney and thinks it was one of the most plain and unattractive chimneys of any of the old companies, being entirely without character. Many are the humourous remarks which have been passed about it including that by Hamilton-Ellis in "The Trains We Loved" when he called it "a muzzle-loader."

Conversely a L.N.W. chimney, with its sturdy square base giving the impression of a solid foundation and undercut top with capuchon, always looked as though it meant business, by the way it barked and threw out red hot cinders when





Three generations of locomotive drivers: F. J., V. M., and F. M. Lewitt with their stud of engines, " George V," " Miss Ten-to-Eight " and " Britannia."

pulling hard and, as its proportions were good, it was decided to model one and send it to Mr Maskelyne.

The chimney was made up to Maskelyne's own outline drawing of *Quail* in M.E., July 24, 1958, but before it could be despatched J.N.M. unfortunately had passed on and the lacquered chimney was left to adorn my dining room mantlepiece for several years.

During this period, however, there was much good natured chaffing from friends as to when the engine would be finished, so in the end we were compelled to take action and complete the job in accordance with the outline drawing from which the chimney was copied. The outline drawing was scaled up to $3\frac{1}{2}$ in. gauge, but as we had no drawing of the mechanism between the frames, the cylinders and motion arrangements of LBSC's *Miss Ten-to-Eight* were adapted to suit.

A cylinder block and steam chest casting were found in a London supplier's scrap box and priced at 10s. because, as the assistant explained, " they were bronze." I paid 15s. for a similar set in 1939 !

The cylinder block casting permitted a length $\frac{1}{4}$ in. longer than LBSC's original design; this was retained and $\frac{5}{8}$ in. long pistons fitted with a single $\frac{1}{16}$ in. wide groove for packing. The scale cylinder size of 1 9/32 in. bore was not adopted: this was not in deference to Mr Harris's principles, but simply because the maximum size the cylinder casting would allow was $1\frac{3}{16}$ in.

The original " George " coupled wheels did not have disc cranks, but many of the later ones did and as the feature was so characteristic of several L.N.W. express classes it was decided to fit this type of wheel. No supplier stocked suitable castings but a scrap wheel casting (from the same source as the cylinder block) was doctored as a pattern and excellent castings were obtained from a local foundry. A point about disc cranks is that the builder has no excuse fo incorrect positioning of the balancing weights on the driving axle.

Shaping the dome was an interesting exercise and it was made from 20 s.w.g. copper sheet by the " raising process " described in M.E. August 19, 1937. It was a most satisfactory piece of work, competing for honours with the chimney.

Other features followed accepted small locomotive practice, i.e., steel axleboxes bronze bushed, correct leaf springing and equalisers on the bogie, axle driven pump instead of centre bearing as on the prototype and case hardened links for the Joy valve gear. Care was taken to ensure correct external L.N.W. details and proportions on such other things as running boards, cab and splashers, smokebox door, engine and tender steps. Painting with lining finally set the job off.

The end product looks a real L.N.W. job and certainly runs like one.

DIESEL ELECTRIC TRACTION

FOR MODEL LOCOMOTIVES

Part III

by F. L. Davies

Continued from page 1237

THE RADIUS of the tips nearer to the yoke bore shown in Fig. 8 as 1.394 in. (0.933 in.) is not critical and can be disregarded. Unless you mill, or plane, the pole profiles it is good enough to saw and file to a fair shape before fitting for the air gap boring, but do not make the tips any thicker than the 0.063 in. (0.050 in.) shown or you may have difficulty in getting the field coils into the available space. The extreme edges of the tips and the corners of the pole body should be rounded to avoid damage to the coil winding or its insulation.

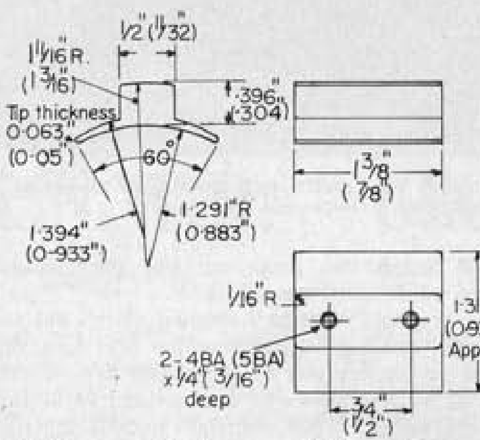


FIG. 8 POLES 4 OFF MS

Armature slot and tooth proportions, together with the gauge of wire to use and the number of turns in each coil, are always something of a compromise between the ideal and the practical magnetic and electrical dimensions one would like to use, and they depend so much on what is commercially available. At one time a great variety of stampings could be obtained from advertisers in M.E. but, in recent years, there has been considerable difficulty in getting small quantities. Perhaps the Queries Dept. knows of, or could ascertain, sources prepared today to supply to the amateur, together with details of the range of sizes, slot numbers and all relevant dimensions of those normally stocked.

My choice of these designs is based on stampings I have used in the last 20 years, but if there have to be changes because of supply difficulty, I can reassure readers that no real problem arises in altering winding details. Fundamentally, for a given output and armature diameter, the number of slots times the number of wires per slot is constant. Provided the total iron area is not altered the number of slots can be increased or reduced, with a corresponding reduction or increase in slot width and number of wires per slot, but the important thing is that the wire cross sectional area must not be altered for a given output or armature current. Fig. 9 shows 15 and 11 slot stampings

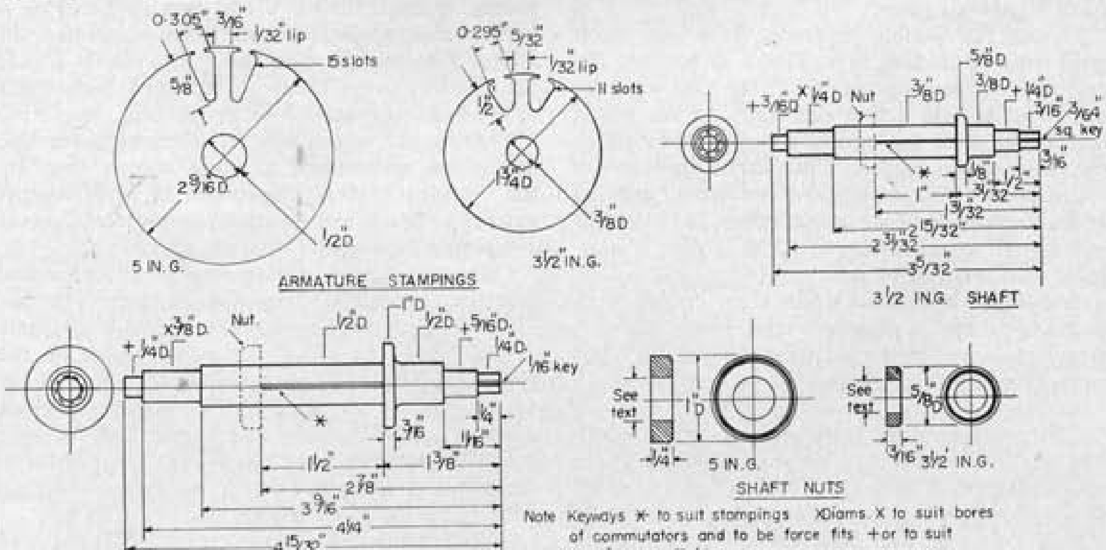


FIG. 9 ARMATURE STAMPINGS, SHAFTS, & NUTS

proposed for the two gauges to suit the windings given later. If one had the details of any other stampings which prospective builders might have to use suitable windings for them could have been worked out for this article. However, such windings can be calculated in a very short time on receipt of full details of the stampings it is intended to use.

When getting stampings, try also to obtain two insulated ends for each packet. These are similar to the stampings but without the tooth lips and they are about 0.063 in. thick. If there is any difficulty in supply they can easily be cut out from Paxolin sheet.

Shafts

Suitable shaft proportions are shown in Fig. 9 and M.E. readers will not need reminding that all changes in diameter must be radiused and not left sharp. Keyways to match the stampings are desirable to ensure accurate assembly and alignment of slots.

The stampings are assembled butting against the large shoulders shown and after pressing into the most compact packet, the shaft nuts are either pressed, or shrunk, on to the shaft. Alternatively the nuts could be screwed on and locked. In that case both shaft and nut should be screwed 26 t.p.i.

Commutators

In these motors we are very much limited in axial length, hence the dimensions in Fig. 10, which must not be exceeded. Construction is a fiddling business so if it is possible to obtain suitable commutators commercially, time and patience will be saved. Essentially the parts are a steel sleeve with a flange, bored to a force fit on the shaft and screwed to take the clamping nut. Both flange and nut have a Vee-shaped annulus for the rigid clamping of the copper segments. The segments are machined with a radial taper and vee recesses to match those in the flange and nut, but machined larger to allow for insulation. That insulation consists of hot-pressed micanite rings.

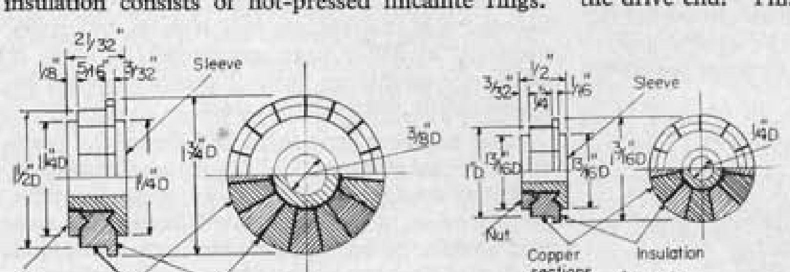


FIG. 10 COMMUTATORS

Similar insulation must be put on the sleeve and pure mica strips placed between the segments. The whole lot is then assembled hot and screwed up tightly, afterwards cutting a narrow saw cut in the radially projecting part of each segment, into which the armature coil ends are eventually soldered. The final skimming up of the commutator is left until after the winding is completed.

Brush holders

Fig. 11 should make clear how these are built up from square brass tube and Tufnol rod. The tube should be a force fit in the body and the latter cemented or pressed tightly into the large holes in the yoke. The brushes must be a smooth sliding fit in the holders and have their inner faces bedded to the radius of the commutator working surface.

The connections to the brushes are made via the clips which are soldered to the projecting portion of the brass tube. With four-pole motors using the windings given, opposite brushes can be cross connected in pairs with one outgoing lead from each pair to the external supply (see Fig. 16). This arrangement halves the current per brush and enables us to use relatively small brushes, while keeping the current density in the brushes low. The brush pressure is maintained by fairly light compression springs but some experiment may be necessary to decide just how strong they need be. Although the caps over the outer ends of the holders look large they should not get in the way of any parts of the bogie structure.

For the actual brushes some of the types supplied for domestic electrical apparatus such as vacuum cleaners can be used. You may have to grind them down to the sizes shown but this is an easy matter if done with care.

Connection leads

Two Tufnol bushes are shown in Fig. 12 and these are fitted one at each end of the yoke. The two leads from the brushgear come out at the commutator end and those from the field coils at the drive end. This enables the bushes to be kept small and it conveniently separates armature and field leads making identification easy.

In 5 in. gauge the input is 188 watts per motor and at 30 volts the normal current is 6.3 amps. The current density in the armature wires should be about 2,500 amps per sq. in. so 19 s.w.g. will be suitable. Modern enamel insulation is extremely tough

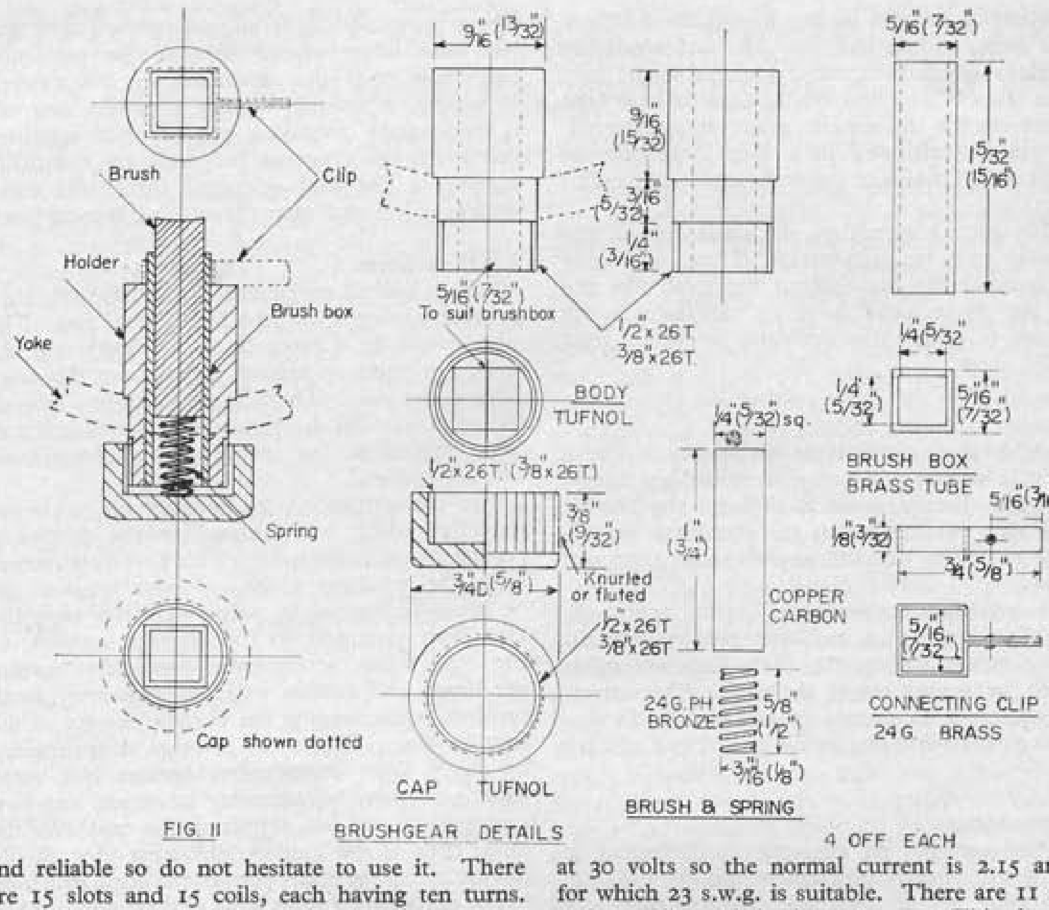


FIG. 11 BRUSHGEAR DETAILS 4 OFF EACH

and reliable so do not hesitate to use it. There are 15 slots and 15 coils, each having ten turns. The winding is what is known as a wave type, each coil spanning approximately one-quarter of the armature periphery, with the start and finish going to commutator segments 180 deg. apart. Fig. 14 shows how the coils and connections are arranged, the first coil lying in slots 1 and 5, the second in slots 2 and 6, and so on. It will be seen that the start of coil 1 is not connected to the segment opposite that slot but to one to the left, roughly opposite slot 14. Similarly the finish of coil 1 goes to the ninth segment from the start, nearly opposite slot 7. Once these are settled the rest follow in sequence round the commutator.

For 3½ in. gauge the input is 63 watts per motor

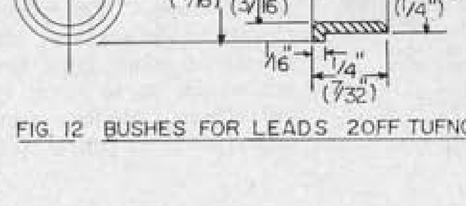
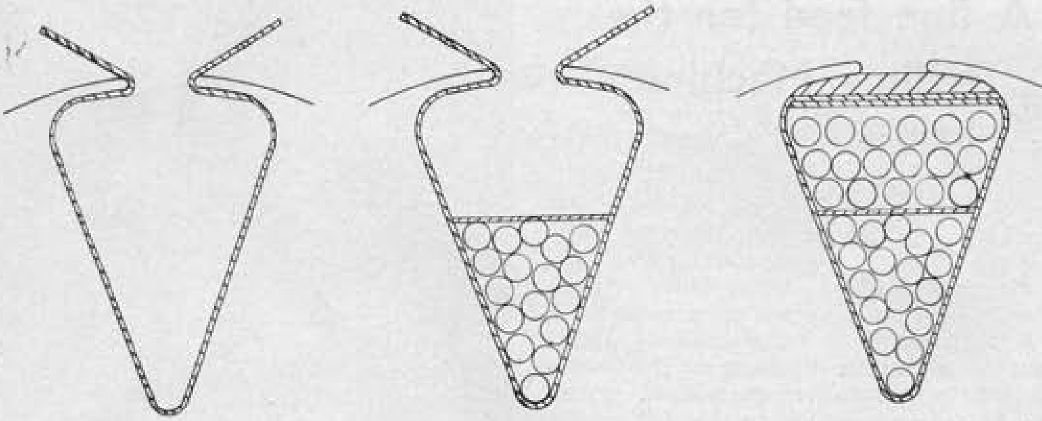


FIG. 12 BUSHES FOR LEADS 2 OFF TUFNOL

at 30 volts so the normal current is 2.15 amps, for which 23 s.w.g. is suitable. There are 11 slots and 11 coils, each having 28 turns. This time the coils go in slots 1 and 4, 2 and 5 and so on. The start of coil 1 goes to the commutator segment opposite slot 10 and the finish to the seventh segment from the start opposite slot 5, and again the rest followin sequence. Fig. 15 shows this arrangement.

In both cases the slot lining insulation can be 10 mils thick total, made up of 5 mil leatheroid for mechanical protection, plus 5 mil varnished cambric or glass tape for electrical protection. A separator between top and bottom half coils is not really necessary in low voltage motors but, if used, it can be the same 5 mil tape. The wedge should be Paxolin strip about 0.05 in. thick.

A lot has been written in M.E. over the years about the actual mechanics of armature winding, so repetition is unnecessary. Suffice it to say that coils preformed on a simple wooden former are well worth while, to ensure symmetry and mechanical balance of the complete armature. Before inserting any of the coils, insulate both the large flange and the shaft nut with the 5 mil tape, wrapping about



A. Slot liner in position   B. Half coil plus separation   C. Winding complete, liner ends turned over and wedge fitted

FIG. 13   STAGES IN WINDING

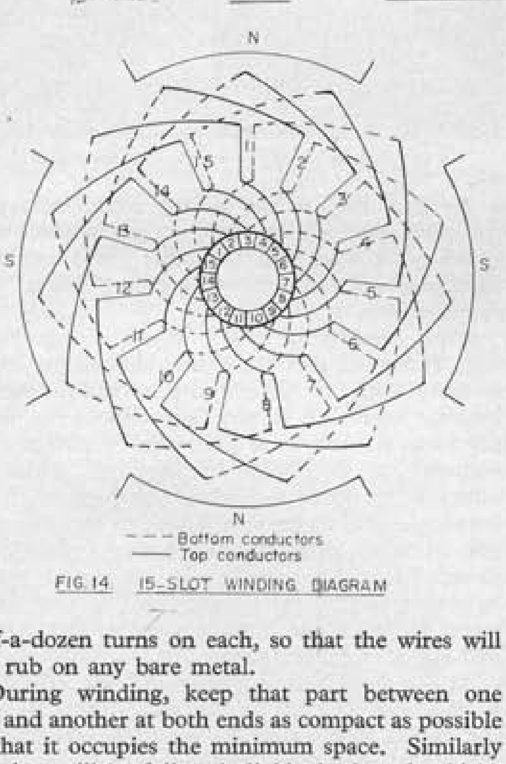


FIG. 14   15-SLOT WINDING DIAGRAM

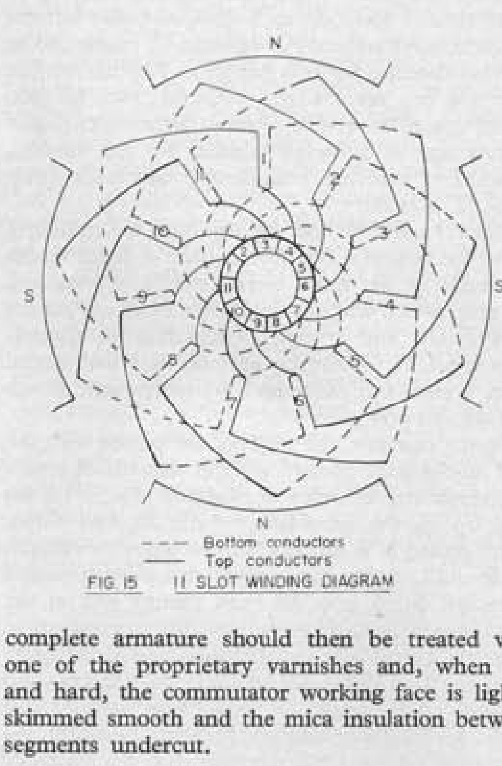


FIG. 15   11 SLOT WINDING DIAGRAM

half-a-dozen turns on each, so that the wires will not rub on any bare metal.

During winding, keep that part between one slot and another at both ends as compact as possible so that it occupies the minimum space. Similarly the slots will be full so individual wires should be pressed down carefully one by one before pushing in the closing wedge. Sometimes it is a help to use half wedges pushed in from each end.

When connecting the coil ends to the commutator, clean and tin them before soldering into the small saw cuts in the segments, interweaving the 5 mil tape above and below alternate connections, with a final wrap of tape overall, followed by a binding of strong thread or thin twine. The complete armature should then be treated with one of the proprietary varnishes and, when dry and hard, the commutator working face is lightly skimmed smooth and the mica insulation between segments undercut.

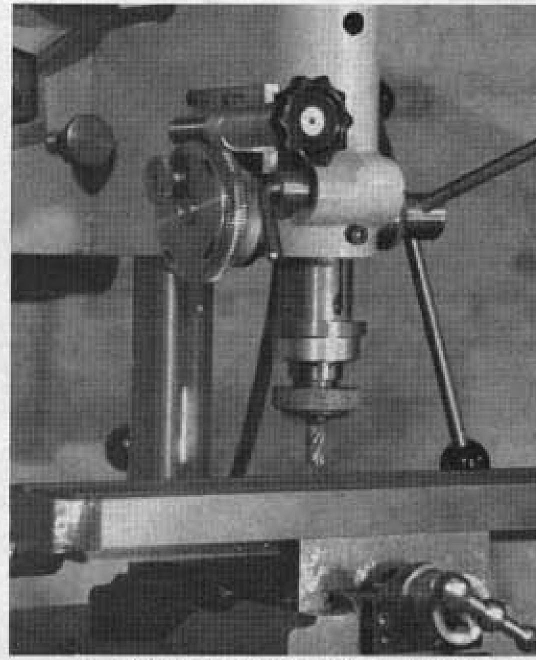
Field coils

A wooden former is useful to get all four coils alike and to make winding easier. The centre should be slightly larger all round than the pole body. The space available is very limited and the curvature of the yoke such that the coils are roughly trapezoidal in cross section, so taper the centre of the former.

To be continued.

A fine feed for the Drilling Machine

by Nathaniel Cohen



View showing the completed fine-feed attachment.

AT THE BEGINNING of this year an article was published in *Model Engineer* describing the building of the "Cowell" drilling machine from their set of machined castings. Before saying anything further I would like to express my admiration for Mr A. Eastham, the contributor, on his skill in making up the machine. Finishing the spindle on a 3½ in. lathe is no mean feat, one which I contemplated when I was considering this drill myself, and decided that I would not attempt.

I purchased the machine for the express purpose of being able to use it for light milling, in addition to its normal function as a drill, and also bought the compound table set of castings to enable me to use the machine for this purpose. Making up the table did not involve any difficulty and, in fact, turned out to be a very pleasant exercise in thread turning and in spherical turning for the handles, in which I received considerable assistance from Mr E. T. Westbury.

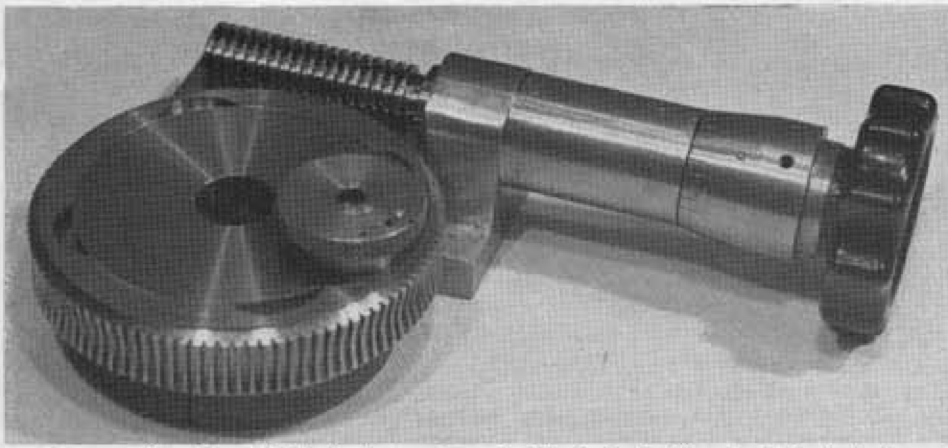
When I came to use the machine for milling I found the lack of a fine feed control a disadvantage and made up my mind to rectify this as soon as I was able, which was not until after I had moved my family, self, and complete workshop to Canada from the U.K. However, as soon as I had settled down a start was made and my subsequent efforts have proved very successful.

On my machine, the mesh of the pinion with the rack on the quill allowed a slight amount of rotary movement and in order to eliminate this, I set the quill up on the cross-slide of the Myford Super 7 and milled a 3/16 in. slot almost the whole length of the quill. A cap head screw with the end turned plain was fitted into the head casting and at the same time a light alloy housing was turned up to cover the thrust bearing at the bottom of the quill. This helps to keep dirt out of the bearing, and prevents oil being flung out when in use. At this stage the spindle and quill were carefully reassembled taking particular care with the clearance left in the thrust bearing, a disc of PTFE was substituted for the fibre washer under the locking collars. A word of warning: it is essential to remove the whole spindle assembly from the drill in order to make this adjustment for end play. It can be done through the oil hole in the top of the head casting, but the job cannot be done properly this way. The amount of clearance left in the thrust bearing is very important if accurate end milling is the final aim, as the locking cotter locks only the quill, and very fine cuts are not possible with a sloppy spindle. On the other hand any over tightening will cause the bearings to "Brinel" and ruin the races.

When considering how I would arrange a fine feed, I decided that the main requirement would be that it could be brought into use and disengaged with the minimum of time and without the use of any tools; also that its action would be quite positive without the possibility of slipping. This was achieved by fitting a bronze worm wheel to the housing of the return spring, free to turn but capable of being locked to the housing by turning a thumb latch. The assembly of the parts is shown in photograph Fig. 2. Photograph Fig. 3 shows the wheel fitting on the housing with the detents cut, and Fig. 4, the thumb latch.

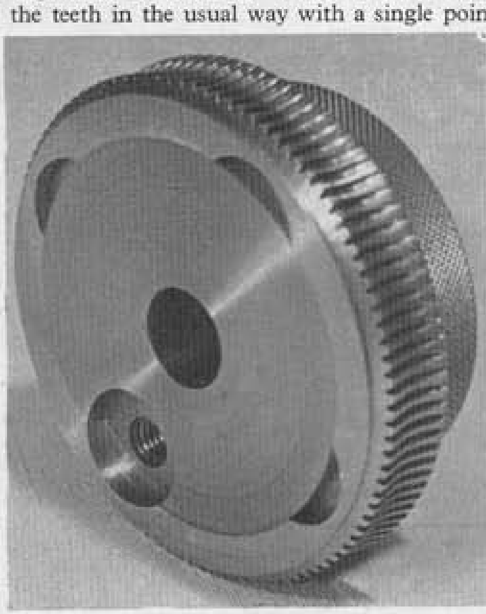
As I already had a home-made hob of 32 d.p. I made this the pitch of the gear. The pinion on the drill is 16 d.p. and one complete revolution of the pinion shaft gives a movement of 3 in. to the spindle. My piece of bronze was just sufficient to obtain 100 teeth and, with a single start worm, a complete revolution of the worm would provide a movement of 30 thou, therefore an index with 30 graduations on the worm shaft would indicate one thou settings. Fortunately the housing is well fitted to the pinion shaft, and this shaft has centres. I purchased my drill completely made up by Messrs. Cowell so that it was simply a matter of cleaning

Fig. 2. A view of the completed attachment for the drilling machine.



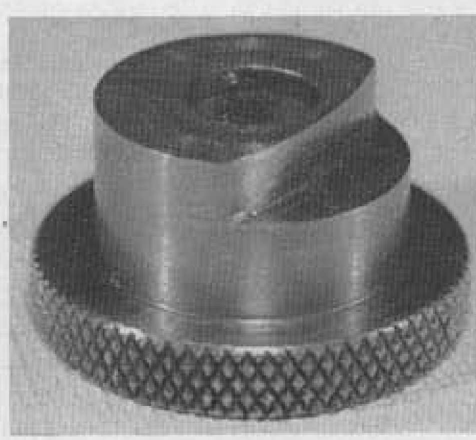
out the centres and mounting the spindle in the lathe with the spring housing assembled, and turning down sufficient of the knurling to obtain a smooth bearing for the required width of the worm wheel—only the minimum required for this bearing was taken off. The internal diameter of the gear was then turned to a light press fit on this bearing surface and all further machining, including final hobbing of the teeth, was done whilst the wheel was fitted firmly to this sub-assembly.

Quite an amount has been published recently in *Model Engineer* on the hobbing of worm wheels, and I have deliberately refrained from making detailed dimensioned drawings of the parts, as my experience has been that one tries to use such materials as one has to hand, or can beg from different sources, and the pitch of the gear is not important, so could be varied at will. I gash out the teeth in the usual way with a single point tool, using the Myford dividing head for indexing, set up on the swivelling vertical-slide adjusted to the helix angle of the worm, the tool being a broken centre drill set in a boring bar between centres. Readers may be interested in my method of grinding the point of this tool. As an optical comparator, I use an old 8 mm. cine editor, suitably modified by the removal of the revolving prism and film transport. Knowing the magnification, which is usually fairly high in these things, a tooth section of the gear is drawn to correct geometrical construction on a piece of mylar film, as close as possible in scale to the magnification of the editor. The film is then laid on the viewing screen and the point of the tool placed at the point of focus normally occupied by the 8 mm. film frame. I use a small hand-held, high-speed grinder to form the shape and am able to obtain a very close tooth form, leaving very little to clean up with the hob. I use this method for making all my gear cutters, which over here are so costly as to be out of the question as far as commercial ones are concerned. The magnification obtainable on my own editor is × 10 which is very convenient.

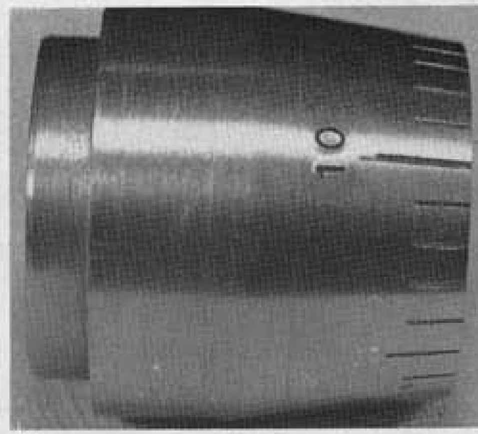


Left: Fig. 3. The bronze worm wheel.

Right: Fig. 4. The thumb latch.



Left: Fig. 5. The nut for the worm shaft.



Right: Fig. 7. The index.

The next operation is the drilling and tapping of the hole in the end face of the spring housing. After counterboring to a suitable depth, the gear is removed from the housing and further replaced in position to cut the other detents, taking care on the depthing. In my case I felt that four such detents would be enough, but of course one can make as many as one wishes. The wheel can now be removed and the spring housing, mounted on its shaft, put back into the lathe to take off the last, minute amount on the bearing surface, to enable the wheel to turn freely on it. The amount that will have to come off should not be more than about three thou at the most, so a really keen tool, carefully applied, will do the trick.

The illustration of the thumb latch is fairly self-explanatory, the radius of the rebated portion corresponding to the inside diameter of the worm wheel. This was done by filing, the depth being such that it just fits snugly to the face of the worm wheel when the wheel is in the free position. It is this and the worm itself which keep the wheel in position on the spring housing when all is complete, the thumb latch being secured to the spring housing with a shouldered, cap-head screw.

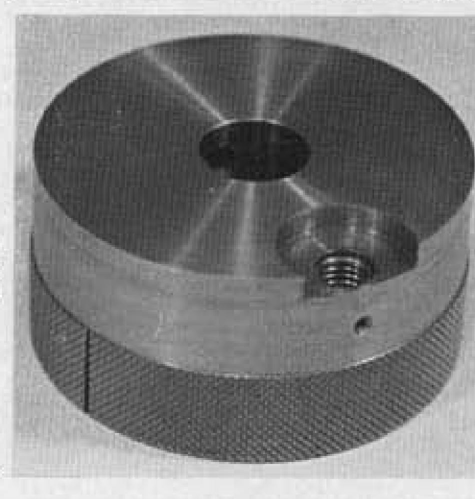
The worm itself needs no explanation and, as can be seen in its illustration with the finished wheel, is simplicity itself. I used a good mild steel for this and finished all machining to a fairly fine polish.

The bearing bracket was obtained from Messrs. Cowell, who had in the past considered designing a similar arrangement, in the form of a clutch bearing on the face of the spring housing; in fact they did not proceed with this and the bearing bracket was the only one they had. So I would ask any reader contemplating making a fine feed not to write to Messrs. Cowell for this part, as it would be worrying them unnecessarily for something they are not able to supply.

Perhaps at this stage I should mention that I have no connection with this firm, other than being a very satisfied customer who found dealing with them a pleasure. Actually I consider the use of a solid bronze casting for the bearing bracket rather an extravagance and suggest that a piece of b.m.s. bar be welded to a piece of flat of the same material and bushed each end with bronze bushes. An advantage here would be that the hole could be bored before welding, the bushes being pressed in afterwards and line-reamed to size, the size of the parts being selected so that the c/l of the worm coincides with the c/l of the wheel, on assembly to the drill head casting.

The holes in this bracket have to be arranged so that the screws can be entered after everything else is in place, and it can be seen in the photograph

Left: Fig. 6. The bearing bracket.



Right: Fig. 8. The return spring housing.

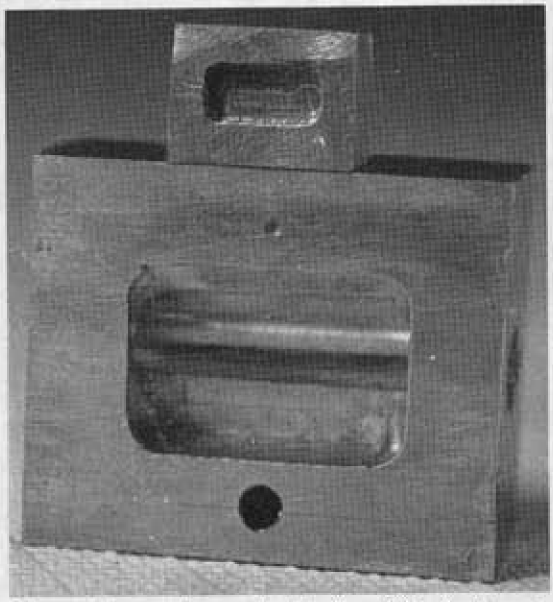


Fig. 9. A steam chest and valve for a Weir feed pump.

that I fell into this trap myself. Although not important, and in fact is not even seen when assembled to the drill, this nevertheless indicates a lack of care in the initial planning, which proves embarrassing if one eventually tries to describe its making using photographs, as I am trying to do, unless of course some kind blockmaker helps me out with an airbrush—plasticine filling did not work !

The only other parts are a plastic handwheel from the odds-and-ends box, the index made from mild steel, with a small grub screw to lock solid onto the worm shaft and a nut.

To assemble, the pinion shaft is entered back into the head casting of the drill and the spring housing firmly locked on to this shaft after adjusting the spring tension. The worm wheel is then oiled and placed on the housing and the thumbscrew secured with its screw. The worm bracket is screwed loosely to the drill head casting, holes having been drilled and tapped for the purpose. The worm is threaded on to the wheel, and the bracket adjusted for correct mesh before finally tightening its three screws, index, handwheel, and nut being assembled to the worm shaft to finish.

It may be found necessary to adjust the lever of the quill locking cotter so that it does not foul the wheel when locking the quill, but this is a fairly simple matter.

The final question now is, how does the whole machine perform in practice when used for milling? I have taken enormous liberties in my interpretation of the term " light end milling." All the connecting rods on my locomotive were milled from the flat in one pass, taking cuts about $\frac{1}{4}$ in. square: the cutters were held in Myford collets and were sharp, while much cutting oil was used. One of my photographs shows a dovetail being milled, with the same cutter, in the cast-iron cross-slide of a small lathe I am making; this was photographed off the machine for clarity. At the other end of the scale is the steam chest, and valve for an LBSC design Weir pump which was all milled from the solid, the recess on the valve measuring $\frac{1}{8}$ in. × $\frac{3}{16}$ in. Very good surface finishes are obtained, and quite a high order of accuracy can be held. I have used end mills $\frac{1}{16}$ in. dia. up to $\frac{1}{2}$ in. dia., doing many jobs which I would otherwise not have been able to have tackled, and at the same time, the drill can still be used with drills down to No. 70, provided care is taken. ▣

Making a Start

SIR,—I would like to endorse the comments made by Mr Bryan E. Morgan in M.E. November 1; his opinions coincide exactly with mine, and I have good evidence to support the idea that those who insist on having all the equipment they want before starting model work, rarely make the best use of it when they get it! Nearly all the successful model engineers I know personally started with the most primitive equipment, or practically none at all; while the " end products " of many workshops in which every machine, tool and appliances are readily to hand are neither prolific, nor distinguished by specially high quality. This is paradoxical, but true.

Granted that workshop equipment is essential to construction of mechanical models, it is of secondary importance to the *know-how* which can only be obtained by tackling difficult or near-insuperable problems with inadequate facilities. Mr Morgan is quite right in saying that the beginner who is struggling to produce a model, however humble, can rely on the assistance of older and more experienced model engineers, especially if he joins a model engineering society. Ambitious projects may have to be deferred, but there is always something which can be done with a few simple tools, and the really essential items of equipment can be acquired gradually if one is not too impatient. As the poet says: " Do the thing that's nearest, though it's dull at whiles".

Belmont. EDGAR T. WESTBURY.

" SIMPLE MODEL LOCOMOTIVE BUILDING . . . INTRODUCING LBSC's TICH."

Our book production department much regret that an error occurred in the captions of some of the photographs. The *Tich* shown in Plate 3, top and bottom, Plate 6, top, Plate 7, bottom, Plate 8, top and bottom, was built by Mr C. F. Collins of Brighton.

The *Tich* on plate 15, top, was built by Mr A. Breese of Tunbridge Wells, and the boiler in Plate 23, top, was the work of Mr B. Croucher of Brighton. The photographs were by Mr G. F. Collins.

CLUB NEWS

R.A.F. Rally

A small but thriving Steam Locomotive and Model Engineering Club has existed at Royal Air Force St. Athan for the last six months. Membership is small and confined to R.A.F. personnel and associated civilians but what the Club lacks in numbers it gains in unsurpassed facilities and an excellent clubhouse.

By kind permission of the Station Commander, it is intended to hold a rally at R.A.F. St. Athan on February 9, 1969, and a cordial invitation to attend is extended to all model engineers.

The event will be held in a heated and well-lit hangar so the weather is of no consequence. The Club's own collection of five full size engines will attend, at least two in steam. Facilities for running 5 in. and 3½ in. gauge locomotives will be available; also refreshments at modest prices.

For permits to enter R.A.F. St. Athan, please write, stating numbers in party, to the Secretary, M. D. Garrick, 6 Fairfield Rise, Llantwit Major, Glamorgan, CF6 9XG.

Golden Jubilee

Founded in 1919, the Huddersfield S.M.E. celebrate their Golden Jubilee this year, and to mark the anniversary have arranged to hold an exhibition at the Drill Hall, St. Pauls Street, Huddersfield, on April 5. and 7. (Easter Saturday and Monday). The support of model engineers in sending models and in attending is requested and entry forms will be available from the Hon. Secretary, Mr E. A. Preston, 8 New Grove Drive, Huddersfield, HD5 9LN.

New Secretary

The new secretary of the Chichester and District S.M.E. is Mr A. Kilvington, 37 Belgrave Crescent, Donnington, Chichester, Sussex.

Stockport move

On and after January 3, 1969, meetings of the Stockport and District S.M.E. will be held on the first and third Fridays of each month at 7.45 p.m. in the Stockport Photographic Society's new premises at Borough Chambers, High Street, Stockport (next to *Advertiser* office). Interested visitors will be welcome.

The Late J. Hartley

The Bournemouth & District S.M.E. regrets to report the death following a car accident, of John Hartley, a vice-president, on November 23. Although not a very active member in recent years, his massive encouragement of the Society's new miniature railway did much to bring it into being. He will be sadly missed by his many friends.

Talyllyn record

With a total train mileage (including empty stock working) of 7,992 and an increase of 13,280 in the number of passenger journeys made (122,167), 1968 has been another record-breaking season for the Talyllyn Railway.

During the winter months, an intensive work programme must be completed, besides the normal winter maintenance programme for locomotives, rolling stock and track. This includes the extension of the locomotive shed at Pendre, incorporating a new inspection pit, and a new passing loop at Quarry Siding, while contractors have begun work on the new station at Abergynolwyn. The Society would be pleased to welcome new members who are prepared to assist with this work.

CLUB DIARY

Dates should be sent five weeks before the event.

January 3 East Sussex Model Engineers. Talk: "Water Supply to Towns, with special reference to Hastings," by Peter Tucker. Congregational Church Hall, London Road, St. Leonards-on-Sea, Sussex.

January 3 Model Engineers' Society (Northern Ireland). Annual General Meeting.

January 3 Rochdale SMEE. Annual general meeting. Lea Hall, Smith Street, Rochdale. 7.30 p.m.

January 3 Romford MEC. Watson Shield Night. Ardleigh House Community Association, 42 Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

January 4 Warrington & District MES. Construction work at new site. Spastics Society's Home, Daresbury, Nr. Warrington. 2 p.m.

January 6 N. Wales MES. Talk: "Petrol Engines," by Mr R. Dean. Penrhyn New Hall, Penrhyn Bay, Llandudno. 7.30 p.m.

January 8 Birmingham SME. To be arranged. Endwood Hotel. 7.30 p.m.

January 8 Harrow and Wembley SME. Jumble sale. British Rail Sports Pavilion, Broadfields, Headstone Lane, Harrow. 7.45 p.m.

January 8 The Northern Mill Engine Society. Meeting. Spread Eagle Hotel, Cheetham Street, Rochdale. 8 p.m.

January 8 Norwich & District SME. "Tools and gadgets." The Assembly House, Theatre Street, Norwich. 7.30 p.m.

January 9 Harlington Locomotive Soc. Nomination night and films. High Street, Harlington, Middlesex. 8 p.m.

January 9 Sutton Model Engineering Club. Members' 8 mm. cine films. Chatham Close, off Woodstock Rise, Sutton, Surrey. 8 p.m.

January 10 Colchester SMEE. Members' movies, 8 mm. projector available. Messrs. Sayer and Benjamin will have some railways film to show.

January 11 Warrington & District MES. Construction work at new site. Spastics Society's Home, Daresbury, Nr. Warrington. 2 p.m.

January 13 Historical MRS. "Signalling Model Railways," by J. T. Howard Turner. Keen House, Calshot Street, London N.1. 7 p.m.

January 15 Model Engineers' Society of N. Ireland. Annual dinner. Stormont Hotel, Upper Newtownards Road, Belfast. 7.15 p.m.

January 16 Derby SMEE. Annual general meeting. C. & W. Welfare, Longbridge Lane, Ascot Drive, Derby. 7.45 p.m.

January 16 Harlington Locomotive Society. A.G.M. High Street, Harlington, Middlesex. 8 p.m.

January 16 Nottingham SMEE. "Work in Progress" meeting. Friends' Meeting House, Clarendon Street. 7.30 p.m.

January 16 Sutton Coldfield & N. Birmingham MES. Building a Locomotive—Part IV. "Hare & Hounds," Gravelly Lane, Erdington, Birmingham. 7.30 p.m.

January 16 Sutton Model Engineering Club. Talk: "Hits and Misses," by W. Hayward. Chatham Close, off Woodstock Rise, Sutton, Surrey. 8 p.m.

January 17 Romford MEC. Annual general meeting. Ardleigh House Community Association, 42 Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

January 18 Warrington & District MES. Construction work at new site. Spastics Society's Home, Daresbury, Nr. Warrington. 2 p.m.

January 20 Chesterfield Model Engineering Society. "Any Questions," with answers from the members. Canteen: Bryan Donkin Ltd., Chesterfield. 7.45 p.m.

January 20 North Staffs. Models Society. "Boats" evening. Pitfield House, The Brampton, Newcastle, Staffs. 7.30 p.m.

January 21 Chichester & District SME Talk: "Welsh Valley Railways," by Mr A. Simcocks. The Lancastrian Boys' School, Basin Road, Chichester. 7 p.m.

January 21 Northampton SME. Film show. Kingsthorpe Community Centre, Kingsthorpe, Northampton. 8 p.m.

January 22 Birmingham SME. Photographic Competition (8 mm. cine). Endwood Hotel. 7.30 p.m.

January 22. Harrow and Wembley SME. Annual general meeting. British Rail Sports Pavilion, Broadfields, Headstone Lane, Harrow. 7.45 p.m.

January 22 Historical MRS. "Midland Railway Carriages of the London Extension," by R. C. Lacy. Bushmead Primary School, Luton. 7.30 p.m.

January 22 The Northern Mill Engine Society. Meeting. Spread Eagle Hotel, Cheetham Street, Rochdale. 8 p.m.

January 23 Glasgow SME. "The World of William Graham," John Thomas. 25 Fordyce Street, Glasgow. 7.30 p.m.

January 23 Harlington Locomotive Society. Railway slides presented by Mr J. S. Gilkes. High Street, Harlington, Middlesex. 8 p.m.

ERRATUM

Drum water clocks by D. L. Pearson. Page 1184, left-hand column:—

The perspex used was [illegible] in. thick, not [illegible] in. as stated.

POSTBAG

Nautical units

SIR,—Before taking you to task for confusing units of speed and distance, when the units concerned are the knot and the nautical mile, Mr Dellow—Postbag in the current (October 4th, 1968) issue of the M.E.—would have done well to acquaint himself more fully with this " knotty " subject. Evidently he, like most of those who assert categorically that it is incorrect and lubberly to speak of " knots an hour," doesn't know that—although *nowadays* it has become customary to define the knot as a speed of one nautical mile per hour—not so very long ago (indeed, so recently as the early 1900's) the knot was defined *in accepted authoritative works* as a unit of distance.

Capt. S. T. S. Lecky's *Wrinkles in Practical Navigation* was, in its day, considered to be *the* most up-to-date and forward-looking work on navigation. It was first published in 1881; my copy is the ninth edition (1894). In Part 1, Chapter 2, Lecky says: " Norie and other authorities give the Admiralty Knot as 6,080 feet." The " Norie " referred to, is of course, Norie's *Epitome of Practical Navigation*. This book was originally written before 1800 as the manual of navigation for the officers of the old East India Company, and—continually revised and brought up to date (by W. H. Rosser in the middle 1800's and W. H. Bolt in the '90's)—remained the textbook from which the greater number of British merchant seamen learned their navigation up till World War I. My copy is the edition of 1900, in which (page 68) sure enough we find: " The Admiralty knot is 6,080 feet, and this is the admeasurement usually adopted for the nautical or sea mile."

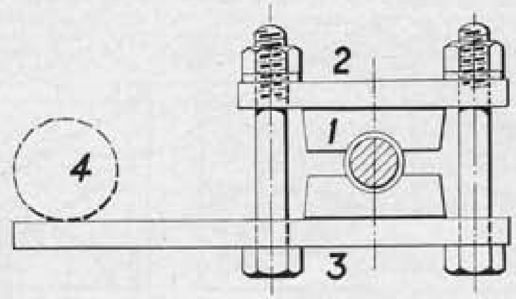
Also, unless my memory is at fault, that indefatigable researcher into the history of navigational matters, Professor E. G. R. Taylor, writing in the Journal of the Institute of Navigation in the late 1940's or early 1950's (I haven't got the relevant issue by me) gave similar but more extensive historical evidence in proof that the custom of defining the knot as a unit of speed is of very recent origin, and that traditionally the knot was a unit of distance, identical with the nautical mile. This is borne out by the following fact (always overlooked by those who insist dogmatically that the expression " knots an hour " is incorrect and lubberly):—There are still extant, and quite readily available, many published writings of the Master Mariners of what I like to think of as the Lecky Era (say, 1870 to 1920), ranging from slim pamphlets on navigational problems to thick autobiographies.

If one takes the trouble to read these, one soon finds that their authors—all of them certificated Masters, and many holders of Extra Masters' certificates—quite often write the " incorrect " and " lubberly " phrases " knots an hour."

Sparkbrook, Birmingham. NORMAN GARDNER.

Lathe carrier

SIR,—I offer something I think might be useful to some people, " a carrier " to grip firmly screwed and polished work in the lathe without spoiling it, by the help of lead, and I think the use of the modern " impact " adhesive to fix the little lead jaws is novel; the illustration is boldly drawn to help the block maker, and no scale, as in a factory this appliance could be made to hold as much as 6 in. dia.; in my case it was only ¼ in. dia.



A few days ago I had to grip a piece of screwed rod in the lathe by means of a carrier, and found I had nothing suitable for the job. A carrier was soon made, in this way:—

I scooped out a hollow in a piece of soft brick, the kind used by bricklayers for " rubbed work," (but Plaster of Paris when hard and dry would do as well), and cast the lead jaws 1, and formed the hollows to grip the work with a coarse round file.

Then I cut a short piece of steel, 2, and a longer piece, 3, and arranged two bolts as shown; the circle, 4, represents the driver pin of the lathe. The lead jaws were united to the steel pieces by one of the " impact " adhesives now found in every workshop, and all tightly fixed round the screwed piece as shown.

The lead did not damage the brass screw; the grip was ample to hold the work when care and very light feed were combined in doing the job.

Mill Hill. N.W.7. H. H. NICHOLLS.

Traction engine boilers

SIR,—As a countryman I am well aware that there are other ways of killing a rabbit than just hitting it on the head. The same is true of almost every activity of life, not the least in model engineering, where some methods are more expeditious than others.

The purpose of this letter is to describe methods of making parts of road engines as alternatives to those described in the *Model Engineer* of August 2nd, 1968.

Out of long experience I find that the best method of making a boiler is to use a continuous piece of tube for the barrel and outer firebox. This simplifies construction and ensures alignment of the engine and square surfaces at the ends, see Fig. 1.

For those who prefer to have the boiler separate from the engine I would suggest that the collar stay shown in Fig. 2 is simpler and preferable to the hollow stay.

By using cap nuts the chance of leakage from stays is reduced to one half. In this scientific age I am astonished at the number of drawings which still show the ordinary nut.

Sealing the cylinder saddle

If Mr Hughes, and others who design model engines, were to put the " doubling " outside instead of inside the boiler they would increase the volume of the boiler, raise the cylinder and thus give greater movement for the reversing gear, but most of all provide a facing to which the cylinder, reversing bracket and pump can be fitted with the greatest of ease.

Following Naval practice, a metal-to-metal joint rendered tight with but a smear of " Stag " jointing paste.

Machining the chimney base

Fig. 3 illustrates the method which I employ for producing the curved surface.

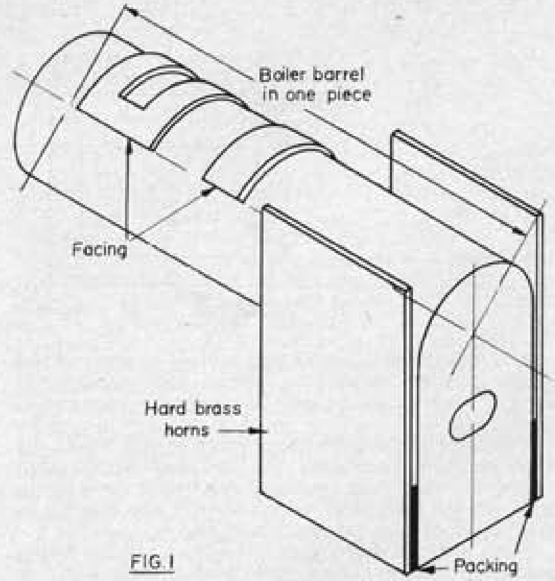


FIG. 1

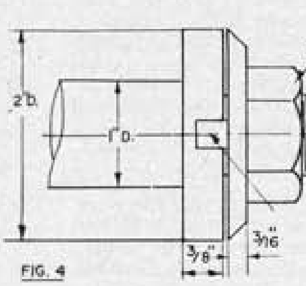


FIG. 4

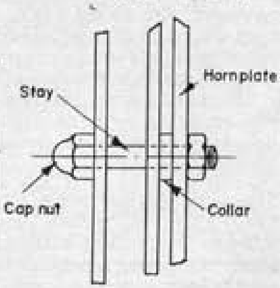


FIG. 2

First bore out the casting to a taper. Machine a plug to fit the taper and tap it to take the holding down stud. By turning Fig. 3 through a right angle it will be seen how the assembly is fixed to the cross-slide of the lathe for milling the curved surface. When this has been done the plug, nut and stud may be used for carrying the casting while the outside surface is being machined.

As Mr. Hughes says, a fly-cutter may be used for producing the curved surface, but a better and more expeditious job is produced by the multi-toothed cutter shown in Fig. 4.

And a last piece of advice from an old man. Only as a last resort use a faceplate or vertical-slide for machining components especially of the heavy variety. The faceplate is an abomination with its clamos and balance weights, whilst the vertical-slide introduces sources of inaccuracy in addition to those inherent in the headstock and cross-slide.

Pickering, Yorks. DIGBY A. WRANGHAM.

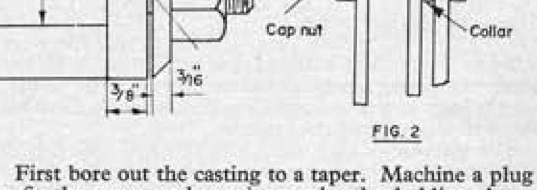


FIG. 3

Flash steam

SIR,—When reading the account by "Artificer" of the St. Albans International Regatta, I was somewhat pained by his remarks on flash steam. Where has he been hiding ? Flash steam is not obsolete, some of its former exponents may be inactive, but not all. Has he never seem my boat *Hero* which still holds the national record at just over 60 m.p.h. And so far as the Crebbin trophy is concerned, it is at this moment nesting on my mantlepiece; but I would be delighted if someone else had it on his mantlepiece this time next year. I admit that I have not been to many regattas, but in the last ten years I have built five steam turbines and three piston engines, and all of them went into a racing hydroplane, but not all were successful.

From conversation with other power-boat men I have found that several are experimenting with steam, but because it is not a simple plant and nothing can be bought ready made, these engines never seem to get public appearances. It might be a good idea to run a series of articles on basic flash steam plants, even to reprint the past articles by the many successful exponents of the art. There is sufficient information in Mr Westbury's book "Flash Steam" for anyone to build a boat that would do at least 50 m.p.h.

Hants. J. A. BAMFORD.

"Artificer" writes:—

Mr Bamford is well known as an exponent of flash steam racing craft, and his boat Hero *has performed with distinction in several past regattas, besides being a noteworthy example of enterprise in individual design. It is to be regretted that he was "pained" by the remarks on flash steam in the report of the International Regatta, but the fact is that not a single flash steam hydroplane took part in any of the racing events. The expression "apparently obsolete" was deliberately provocative, and* intended *to be challenged by some of those who still profess an interest in this fascinating mode of motive power. Unfortunately, very few of them do more than pay lip service to flash steam at present, as it is so much easier to put a ready-made engine into a hult.*

Mr Bamford's suggestion that more articles on flash steam should be published is a very good one, but it would only be worth while if a substantial proportion of model engineers were definitely and actively interested in the subject.

The late Dr Hallows

SIR,—All will hear with regret the passing of Dr Hallows and I feel I should set on record my own appreciation of his many acts of kindness to me in years gone by.

Not all readers of M.E. could have realised he had had a distinguished medical career, as the many lines he had in the Medical Directory testified, and it was a study of these before I first wrote to him some twenty years ago that gave me an indication of his quality. His letters to me were authoritative and detailed and I still have a centre punch he sent me as a wedding present.

I recall my wife was alarmed when on meeting him he told her he had a bed and desk in his workshop, and this liberty has been denied me so far, but his courtly bearing won her heart as it did mine. He was a superb craftsman, and I hope that some, if not all, of the machines he made may find a resting place in some museum of engineering technology or transferred to loving hands for their continued careful use. Possibly the Executive Board will take some steps to see this is effected, as the M.E. must count itself proud and honoured to have had his support for so long.

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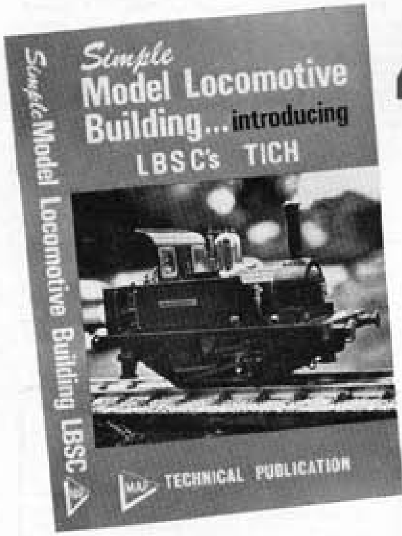

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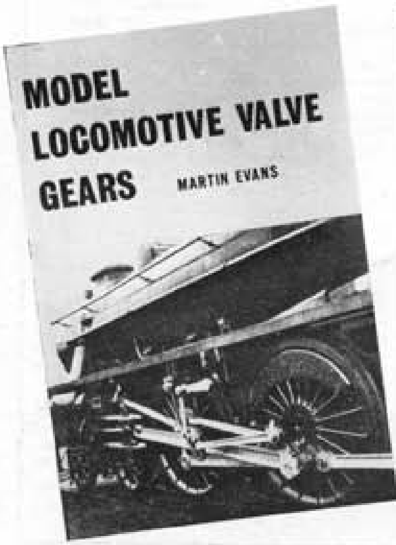

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