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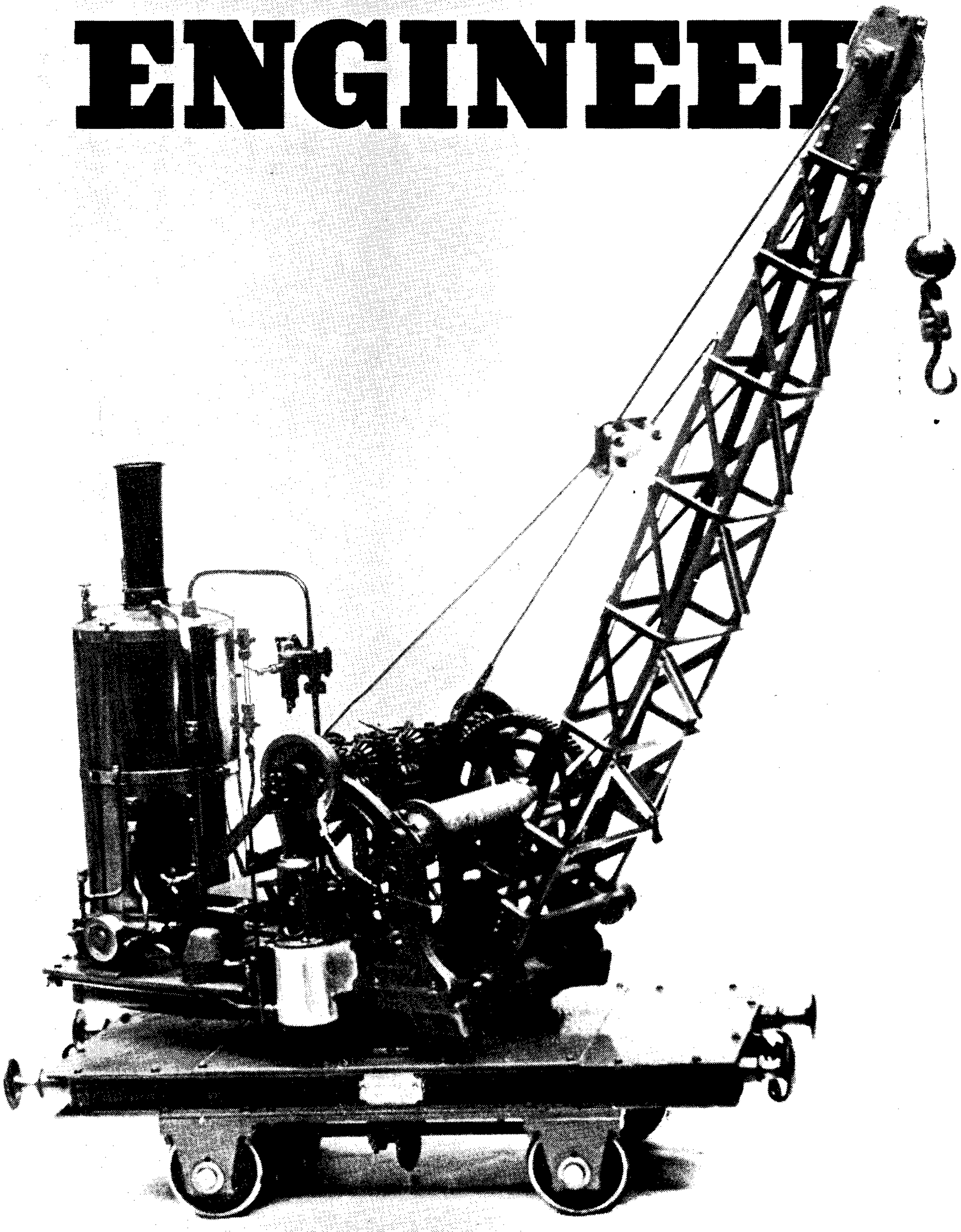
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

29TH NOVEMBER 1951 VOL. 105 NO. 2636

SMOKE RINGS

Our Cover Picture

● THIS SCALE model of a Booth's five-ton locomotive steam crane was built by Mr. F. Midgley, of Leeds, and exhibited at the Leeds Society's 1951 exhibition. All gears were cut by the builder himself on his own home-made milling-machine, using a dividing-head specially made for the purpose. Actually, however, it was the gears which spoiled the illusion of reality, for they were made in either brass or gunmetal. Had they been cut in steel or cast-iron, the appearance of the model would have benefited greatly. The model was built without drawings.

Incidentally, besides his milling-machine, Mr. Midgley's lathe and drilling-machine are also " home-made," and we feel he deserves full marks for this achievement. The photograph was taken by Dewhirst Newsphotos (Leeds).

A Ship Model Society's Achievement

● IT HAS been brought to our notice that so far no mention has been made in our pages of the remarkable achievement of the Birmingham Ship Model Society in winning so many awards at this year's " M.E." Exhibition. We hasten to repair this omission, and would like to add our congratulations to the many they have received.

With only six entries, they actually won eight high awards, namely, four cups, one trophy, one silver medal and two very high grade diplomas. Details of these were as follows : Mr. A. E. Field won the Sailing Ship Championship Cup with his $\frac{1}{8}$ in. scale *Cutty Sark*, Mr. F. A. A. Pariser was the runner-up in this section with his brig *Procrius*, which was awarded the Maze Cup. Mr. A. T. Judd won the Wellingham Cup for the best working model of a steamer, with his coaster *Eleftheria*. Mr. C. J. Clarke won a silver medal for his brigantine *Raven* and Mr. A. E. James with his brig, and Mr. W. A. Cotton with his waterline model of the four-mast barque *Pommern* were both awarded " very highly commended," which is the highest grade of the diplomas. Three of the models were entered for the Club Team Competition which they won, this being the third year in succession in which this award has been won by the Birmingham Society. As if that were not enough, the society has also won the Steering Wheel trophy, offered by Mr. Maltby, of Sheffield, for the ship model society securing the highest number of points in each year's " M.E." Exhibition. We imagine it will be many years before we see another such record. Even for the Birmingham Society it would be a tall order to produce three such models as the *Cutty Sark*, the *Procrius* and the *Eleftheria* in one year.

Thank You

● OUR RECENT appeal for the loan of a number of volumes of THE MODEL ENGINEER, complete with all the advertisements, met with a magnificent response, and our Advertisement Manager has asked us to say "Thank you" to all those readers who so kindly offered to help us. All the volumes we wanted came to hand, and they will be returned to their owners as soon as the information we required has been extracted from them. We are very grateful for the loan of them.

An Attractive Calendar

● OUR CONTEMPORARY, *Railways*, has issued a somewhat novel calendar for 1952, and we think it will appeal to all railway enthusiasts. It consists of a single sheet for each month of the year, with the usual monthly calendar information at the bottom of the sheet. The overall size of each sheet is 9 in. by 11¼ in., and the upper part carries a 7½ in. by 9½ in. reproduction of an attractive train photograph; all twelve show scenes on railways in the British Isles, and most of them are taken from unfamiliar viewpoints.

The twelve pictures, we understand, will be used successively as cover pictures for *Railways* during 1952; but, issued beforehand in the form of this loose-leaf calendar, they can be collected together at the end of the year and either stored or mounted and framed.

Musical Boxes

● WHEN WE published a "Smoke Ring" on musical boxes a few issues ago, we had no idea that so many readers would be interested, or that the response to our request for information would be so readily forthcoming!

Now that we are aware of the demand, we shall do our utmost to satisfy, from time to time, the wants of those who have asked for help and guidance; in the meantime, there is a further query which perhaps some reader might be able to answer. Is there a source of supply, in this country, for pin wire, and if so, where? We have seen that the re-pinning of a cylinder is not the tedious task it at first appears to be, provided that the specially made pin wire is available. Adapting ordinary round wire to this end, however, is a fruit of a different flavour and would be liable to disrupt the mental attitude of the most stolid character!

The "Britannias"

● AS WE expected, the recent withdrawal of the Class 7 Pacific locomotives from traffic, following a mishap to No. 70004, *William Shakespeare*, has caused many readers to write to us, asking for some explanation. Up to the time of writing this note, no official information has come to hand, and until it does, we no know more than our readers.

Obviously, the accident to No. 70004 was serious, though, fortunately, it was not accompanied by any serious results, so far as the passengers in the train are concerned. It has led to the whole class being withdrawn while the matter is being investigated, which is, after all, a wise decision in the circumstances. Such a step has been taken in the past, when there has been cause for investigation into the behaviour, not only of locomotives but of other types of machines used in the public service.

In due course, the results of the investigation into the behaviour of the "Britannias" are certain to be known; modifications may or may not be made in the engines, according to the information that comes to light. The causes of trouble may be very trivial and easily remedied; but they may also be precisely the reverse, and time will show into which category *William Shakespeare's* mishap must be placed. For the moment, we can make no further comments.

"The Rand Modeller"

● WE HAVE been favoured with copies of the first two issues of *The Rand Modeller*, the quarterly news-letter of the Rand Society of Model Engineers, Johannesburg, South Africa. We find it newsy, useful and entertaining, the editor, Dr. A. Deverall, having just the right approach to his none-too-easy task of editing a club magazine of this nature.

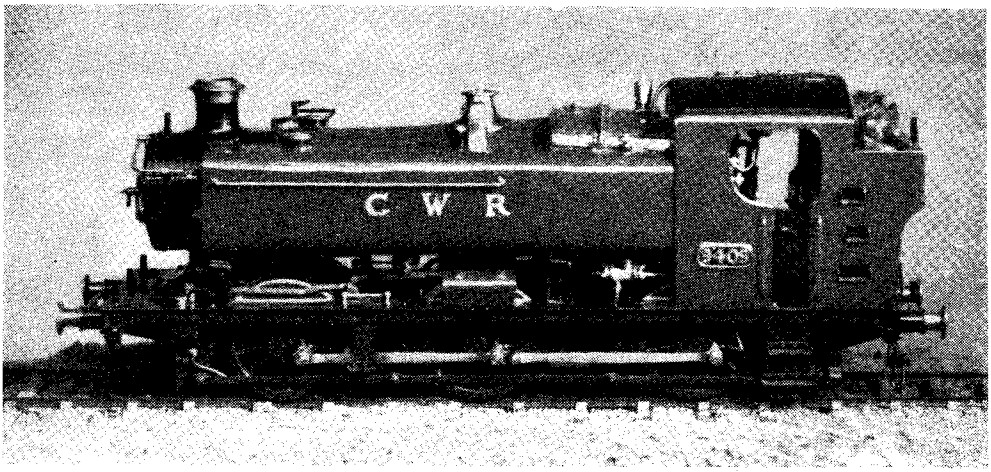
The text is mimeographed copy of typescript on quarto-size paper, the first issue consisting of 14 pages, and the second of 16 pages. In addition, the second issue has two full-page art-paper inserts for halftone illustrations.

The society's accounts and balance-sheet have been divided between the two issues, and we are glad to note that they reveal a sound and healthy financial position. That the society is well managed by its executives is clearly shown, and there is obviously a commendable atmosphere of good humour and friendliness about all its activities. We extend our good wishes to our South African friends and we look forward with pleasure to seeing future issues of *The Rand Modeller*.

The Round Pond

● THE COLD, damp weather is here again and the usual weekend pilgrimages to outlying ponds, by our radio-control and scale motor ship friends, have already commenced to wane. But there is at least one rendezvous where the hardy boys meet regularly through the "off" season—the Round Pond, Kensington Gardens. We mention this fact because we feel that there are many who overlook this splendid body of water. Easily accessible from almost any part of London, it is sufficiently sheltered to render it habitable even by the smaller sailing models right around the calendar, except, of course, for the brief and infrequent periods when it is completely frozen over.

There is one type of craft, however, which is not to be encouraged on the Round Pond, and that is the small high-speed menace which one sees from time to time in hot pursuit of some unfortunate drake. These, happily, are in the minority and their owners usually respond readily to tactful objection, especially when it is pointed out that a collision either with one of His Majesty's birds or with one of the stately sailing ships or radio-controlled cabin cruisers would lead, most likely, to a considerable drain both on morale and pocket!



A G.W.R. 0-6-0 Heavy Shunting Engine "9400" Class

by The Reverend W. F. Oakley, L.Th.

THE prototype of this engine first appeared in a brief description in the July 1947 issue of *The Locomotive Railway Carriage and Wagon Review.* Its characteristic Great Western style, and general appearance made their appeal, and I decided to reproduce it in miniature as far as might be possible. The usual outline blue-print was obtained from Swindon, and apart from main dimensions and outline gave no further information. I did write to Swindon to ask for information on one or two points; but the replies, though courteous, were so brief that it was felt that the Chief Mechanical Engineer's Dept. of a great railway would naturally not wish to spend time in answering questions. For nearly a year and a half I was thus left to my own ideas.

It was, I believe, towards the end of 1948 that W. G. Bagnall & Co. Ltd. of Stafford announced in *The Locomotive* that they had obtained a contract for 50 of these locomotives. At once I wrote to them telling them what I was doing and asked if I could be allowed to see one of these engines in course of construction. A courteous and encouraging reply indicated that when the construction of the first locomotive had progressed sufficiently to give a satisfactory picture for my purpose, a visit from me would be welcomed. At the same time a date about six months ahead was suggested. In the meantime, the work had to go on, and at last about June 1949 I was invited to see the first completed engine, and witness its first steam trial.

The result of this visit was that many details, of which I previously had no knowledge, had to be included.

Having previously made my own drawings of the motion details to scale size, i.e., ¾ in., one was not restricted to making any particular part first; but in general the frame were necessary before real progress could be made. They were marked out with all centre-lines and cut to shape in 3/32 in. steel. Years ago I determined that when next I made a locomotive, holes would be drilled in the frames to take spigots turned on the cylinder castings, with the object of locating these on the centre-line and at the correct distance from the driving axle-centre. My own patterns were made for the cylinders *with the steam-chest in between.* The first cylinder castings had to be scrapped after a good deal of machining. They were hopelessly porous and had serious blow holes. A new pair was obtained. The faces mating with the inside of the frames were faced in the lathe after being set up on a surface-plate for marking the centre lines. At this setting in the chuck the spigots were turned to fit the holes in the frames. Then the castings were reversed in the chuck and the inside faces machined and recessed to take the slide-valves. This was done with a boring-tool to the correct depth, the casting then being pushed along in the chuck by one jaw until the recess was formed. The corner radii were reduced by using an end mill. After this the castings were set up for boring, and a gang milling cutter was made to mill the ports on the valve faces. The steam portways were drilled out 5/64 in., leaving just one or two bridges for strength, the rest of the metal being cut out. The next operation was to make a jig of stout angle-steel to hold the cylinders centrally by the spigots face to face to drill for the middle joint bolts. These joint faces were surfaced by filing and scraping, using glass as a surface-plate, and finally bolting together with marking on the faces.

When the faces showed contact all over, the joint was made with a thin paste of boiled linseed oil and red lead powder.

The next step was to fix the cylinders in the frames, and to obtain the correct inclination two temporary jigs were made to fit tightly in the driving horn-plates. These were drilled $\frac{3}{8}$ in.; and a length of $\frac{3}{8}$ in. steel was drilled at 90 degrees through its axis. This was set horizontally in the horns and a length of ground steel stock, the size of the piston-rods, passed through the piston-rod gland and stuffing-box and the hole in the transverse-rod. The frames were now ready to be drilled for the cylinder casting bolts.

The slide-valves were set in the position intended, first with one port and then with another.

The valve spindles were marked with a one leg trammel from a centre-pop above each valve-spindle gland. The marks on the valve-spindles were registered with centre-pops and finally the steam-chest and cylinder cover joints made with pistons, valves, and spindles enclosed.

It was my intention to arrange the slide-valves without lead, or what is known as negative lead. This gives a late cut off in full gear which is what I wanted.

The cylinders are 1 1/32 in. diameter $\times$ $1\frac{1}{2}$ in. stroke. In other words 1/32 in. below scale diameter with full scale stroke. The valve travel is $\frac{3}{8}$ in. equalling 6 in. valve travel in full size. The eccentrics are 115 deg. in advance of the cranks, that is to say, they have 25 deg. angular advance. It was quite impossible to get the full-size scale diameter of the cylinders. Finally, the dead centres were found and marked on the L.H. rim of the driving-wheels and the valve setting checked. It needed little alteration.

Reference has already been made to the difficulty of obtaining information about the details of this engine at the beginning of the work. One suggestion that these locomotives might be seen at Paddington was not very helpful. It would have been a brief survey at the most. As launch type reversing links had been adopted by the Great Western Railway I took that for granted. The first engine constructed by the contractors W. G. Bagnall & Co. Ltd., of Stafford, showed the links to be of the locomotive type.

The link motion was all made to the launch type as well as the crank-axle, complete with eccentrics to suit these links. So they remain with the consolation that if that type of link is not present-day practice, it was so formerly. The reversing links are fitted with four lifting links with the weigh-bar shaft below the motion, as on the prototype. The point of lift on the link is taken from the middle of the link itself by trunnions.

The connecting-rods have bushed little ends with big end straps, split brasses, cotters, cotter-plates, and bolts. The slots for the cotters were made by drilling through with a $\frac{1}{16}$ in. drill, then an old hacksaw blade was broken to make drifts for drifting out the holes to the shape of the cotters. Flat section bright drawn steel was used for the crank webs. After the machining of the eccentric sheaves, a centre-line was drawn across them; a template made to give 25 deg. advance for the eccentrics by placing one edge against the edge of the crank-web, and setting the centre-line of the eccentrics with a surface gauge and surface plate. The sheaves were secured by long grub screws and after the valve setting had been checked and rectified the sheaves were pegged to the axle. The crossheads are fabricated with steel, brazed and machined for taper piston-rod ends and shod with antifriction metal for contact with the slide-bar surfaces. The piston heads and rings were made of chrome cast-iron.

A boiler feed pump, driven from the left-hand crosshead, takes the place of the G.W. air pump. In connection with this, I remarked to a friend one day that it was a cause of wonder that model locomotive constructors did not use a crosshead-driven feed pump for inside cylinder engines, in place of the eccentric-driven pump. Shortly afterwards "L.B.S.C." for the first time, I believe, specified it for one of his engines!

There was never any intention of hiding a parallel boiler barrel beneath a taper lagging. A taper tube could not be obtained, so the barrel had to be made in two rings with double butt joints. The firebox is stayed in the orthodox manner at the sides and ends, but a suggestion that copper tube distance pieces on the stays between the plates would be an advantage was followed. Two crown girder stays, riveted to the firebox crown and wrapper crown, were perforated with large holes to receive the transverse stays above the firebox crown. Even so, the rods had to have a slight double offset. The ends of the rods were threaded, and enlarged holes in the plate tapped the same pitch, sleeves threaded inside and outside were screwed home and hammered down. These are of bronze. The firebox is fully stayed on all sides and in the professional manner, and above the firebox crown, girder and transverse stays give considerable strength.

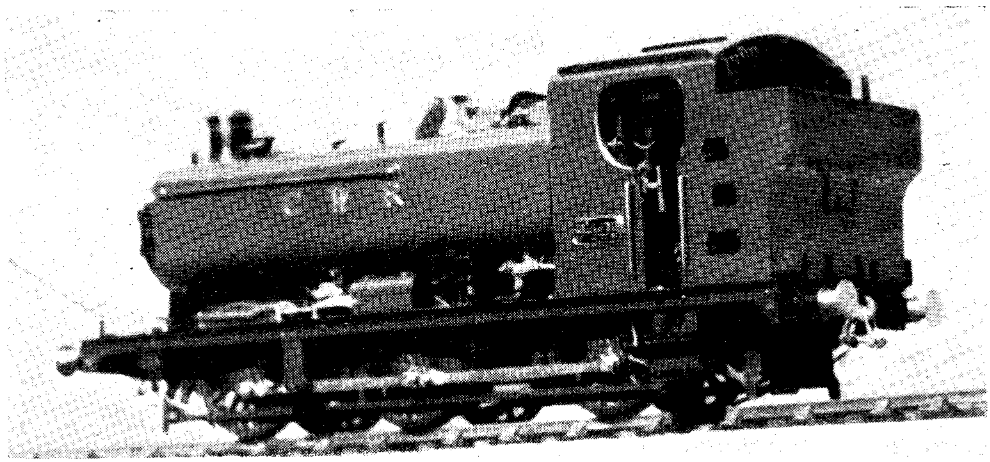
The backplate and wrapper seam were drilled tapping size and tapped 40 t.p.i. the wrapper afterwards being drilled to clearance size and countersunk. The holes were spaced at $\frac{7}{16}$-in. pitch. Countersunk copper screws were made with a spigot outside the head. These were filed square and all screws screwed home with a spanner, and then caulked around the countersink. The squares were then removed; all seams inside and outside and all rivets and stay-heads were finally brazed with Cuprotectic. My intention is to load the safety-valve to 100 lb. to the sq. in. eventually.

I was particularly anxious to see the cab layout of one of these engines and the boiler mountings of the firebox front. It was interesting to see the drip sight feed lubricator with its regulator control. I had previously determined to fit a lubricator of this type to "the words and music" of Mr. F. Cottam's lubricator, described by him in a November 1947 issue of THE MODEL ENGINEER. Here I must ask his pardon, and beg his indulgence, for thinking that it could not be impossible to dispense with his three-screwed rods for holding the glass fittings together, and substitute a method which would occupy less space. A good deal of thought was given to this, and one wakeful night my mind suddenly reverted to the brass tubular shield with its long slot which used to be fitted to the water-gauge glass of portable engines. And so it was made ; a length of $\frac{3}{4}$ in. brass round rod was bored out to take the specified length and size of glass-tube a free fit. The lower end was threaded to screw into the base which was made from a solid piece of $1\frac{3}{16}$ in. brass round, and machined so that the screwed projection for the needle-valve gland was also made in the solid. The top fitting was filed through on three sides to expose the glass.

Approximately 5,000 hours have been spent on the work of construction in a well-equipped workshop at the rate of six to seven hours daily and six days a week. The cab and bunker alone with all their doors, windows, steps, hand-rails and window guards occupied three months.

The hornplates are of fabricated steel, brazed complete with struts or ribs and bolted to the frames. Many bolts, nuts, and split cotter-pins had to be made, also pipe unions.

When I read of some of the quick jobs narrated in THE MODEL ENGINEER, I feel almost envious of the *amateur* model engineer. With a background of professional training and many years' experience, a locomotive to me is a locomotive. That is why the engine described herein is so full of detail, and made in the orthodox style.



A rail level view of the model, showing the cab and bunker

It would be better to make the top outlet union a separate fitting, so that it could be removed to fill the glass with water. The atomising valve for the regulator control was made. It occupied so much space that it was decided to dispense with it. Forty years are a long time, but my recollection of The Vacuum Oil Co.'s first sight drip feed lubricator is that it had no regulator control, so I decided to try without one. The lubricator worked perfectly ; but a very slight opening of the needle-valve was sufficient.

At the only two steam trials so far the injector refused to do its job. The engine showed plenty of liveliness, and power. The regulator, which is in the main steam pipe, was too fierce, but this has been improved. Some of the details may be of interest. The axleboxes have steel keeps secured with two pins. Springs are working laminated with ten plates of hard spring bronze held in a steel buckle. The spring hangers are of the compression type with a spiral spring enclosed in each one. Wick syphon oil-cups are fitted to the slide-bars, slide-valve spindle-guides, and axleboxes. The leading and trailing sandboxes have working gear *with butterfly-valves* all worked from the cab. The brake-valve is of the vacuum brake type ; but in reality supplies steam to the brake cylinder. Top boiler feed is fitted but its reputation is not too good, so we shall have to wait and see. The top part of the cab is removable for driving, the slide-valves ride in buckles.

This work was begun in November 1947 after leaving my last parish for retirement.

Some modifications from the original were quite unavoidable. As, for instance, the feed-water controls near the fireman's feet would be quite inaccessible on the miniature. These had to be placed on the tanks near the cab.

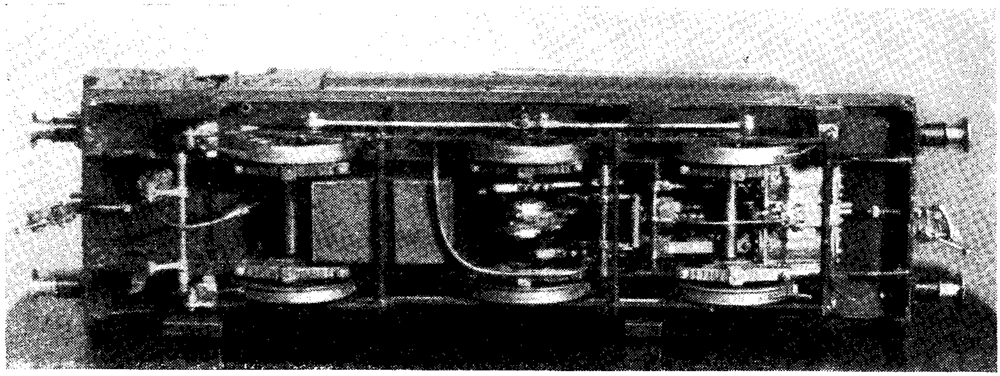
I had no equipment for brazing the boiler, so two other locomotive fans got together, Mr. Alan Holmes and Mr. Jack Ball, and between us it was done with oxyacetylene, and a blow-lamp.

When I saw the first picture of this engine she was G.W.R. She is G.W.R. now, and G.W.R. she will continue as long as she remains in my possession. The whistles are mounted on the firebox and are both overscale. With the exception of the train vacuum pipes which are not yet made there is nothing on the engine that does not work.

On the occasion of my first visit to W. G. Bagnall Ltd., the manager expressed a wish to see my partly completed engine. Frames, wheels and motion were finished. The boiler was partly made with the barrel and firebox shell brazed. It was suggested by the manager that if I would let him have the engine when complete he would place it on show at the works.

At the end of October, 1950 I took the completed engine to Stafford, as arranged. It aroused a good deal of interest in the manager, managing director and other officials, the chief draughtsman, and shop stewards. (The manager expressed a wish that shop stewards should see the engine.) He decided, however, that the responsibility of placing the engine on show was more than he cared to accept.

It must, I think, be placed on record how pleasant an experience I found my visits to these works. It was with some diffidence that I wrote to the firm in the first instance; but any fear that I might be making a nuisance of myself soon disappeared. I was made most welcome, and treated with the utmost consideration.



Underside—exposing the "works"

Although reference has been made to the steam distribution, nothing has been said about the steam supply. So, as an afterthought, it may be pointed out that the boiler main steam pipe is $\frac{3}{8}$ in. in diameter, terminating at the tube-plate in a "Y" union. From this point two $\frac{1}{4}$-in. tubes separate, to enter the super-heater flues, whence they return to be connected to another "Y" union at the steam-chest.

On the matter of steam supply it may not be out of place to make some comment. My 4-6-0 $\frac{3}{4}$-in. scale tender engine—a short description of which with a photograph of the engine appeared in "L.B.S.C.'s" notes in a September 1939 issue—originally had cast-iron cylinders supplied by $\frac{5}{16}$ in. pipe throughout. The engine was rebuilt in 1937 with phosphor-bronze cylinders and $\frac{3}{8}$-in. steam-pipe supply with larger ports and portways. The difference was amazing. From a comparatively puny engine the model became lively and powerful; and had the reputation of being one of the best steamers in North Staffordshire. The object to aim at is to give a generous steam supply and to make the steam-chest and cylinders so that the steam can get to its work.

In these miniature engines condensation, as the late Mr. Henry Greenly maintained, is the greatest bugbear. The way to overcome this, as far as may be, is with large steam-pipes and open portways, with large steam-chests. The engine will not use more steam than the load demands, given good workmanship.

One of our own railway chief mechanical engineers in a paper read before the Institution of Mechanical Engineers two years or so ago strongly advocated a generous steam supply. He urged that steam-pipes of not less than 6 in. diameter should be used on all main line engines, and said that even larger steam-pipes would be advantageous.

Verbum Sapientie

If boilers and cylinders are made to a determined scale of the prototype then the steam supply, including ports, and portways, should be made to the same scale.

On the matter of decoration I had no intention that it would be black. Black! plain black for a £10,000 locomotive! My model was going to be *green* and *brown*, the original G.W. decoration, and so she is, green above the footplate, and brown below. As far as possible the materials were obtained in 1947 and luckily Bonds were able to supply G.W.R. green. The splashers are built up of steel sheet and, as will be seen, are panelled with polished brass edging.

How lovely those old single framed four-coupled passenger engines used to look in their resplendent green with polished brass dome, copper chimney cap, and safety-valve casing, and polished brass beading to the splashers with their nice brown below footplating, and that lovely G.W.R. monogram on the tenderside. Common, dingy, funeral black! Where are men's ideas of beauty, in which colour plays a great part? No black model for me, and I am not particularly concerned with any criticism that may be directed at my reversion to the original G.W.R. colours, or rather the colours I knew, and admired, long ago.

The letters presented a little problem. Ceramic printers in the Potteries were tried for transfers, but it was hopeless. So the choice lay between embossed letters on the tanks, or polishing the brass of the tank and painting around the letters. The former method was preferred as being, perhaps, the more satisfactory.

I did not want brazed eyes to the screw coupling links so they were filed out of flat steel, drilled, and bent to shape with solid eyes.

My only wish is that these models could be reproduced in THE MODEL ENGINEER in their colours.

*A Universal Dividing Head, PLUS

by A. R. Turpin

THE dimensions of the top plate are shown in Fig. 8. Grip the casting in the three-jaw, chamfer side in. Face right across the lug, removing about $\frac{1}{8}$-in. of metal. Drill the $\frac{1}{2}$-in. hole but not the $\frac{3}{8}$-in. hole in the lug. Bore the recess to fit the pillar to a depth of $\frac{3}{16}$-in. and cut the keyway. The method will be explained when dealing with the carriage (5). Reverse the casting in the chuck, gripping it by the inside of the bored recess, and face right across the lug, reducing the thickness to $\frac{1}{2}$ in. Face the nut bearing boss, and reduce the height until it stands proud about $\frac{1}{16}$-in.

Put a plug in the centre hole and carefully mark out the position of the hole in the lug. This hole must be drilled truly at right-angles to the base, so proceed in the following manner.

Centre drill with a BS3 centre drill, this has a $\frac{1}{4}$ in. diameter body, and drill deeply so that the body portion enters at least $\frac{1}{2}$ in.; this will necessitate continual withdrawals of the drill to prevent it clogging and breaking; and then drill right through the lug with a sharp and accurately ground $\frac{1}{4}$ in. drill. This should give you a perfectly straight hole; leave it at this size for the time being. Drill and tap the 2 B.A. hole for the pin which carries the cursor line, and the top plate can be put aside for the time being.

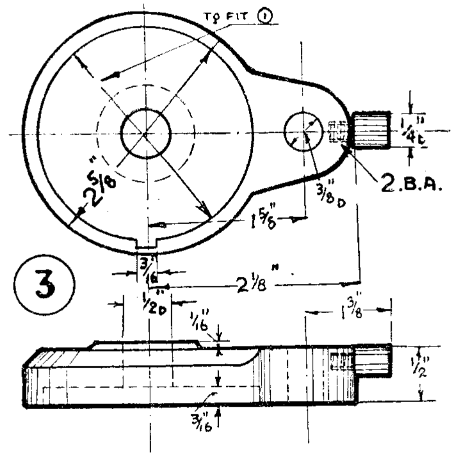


Fig. 8

to form the main body and then turn down a portion on either end to 2 in. diameter to form the core prints.

The lug can be made in the same way as that for the top plate, using material of the necessary thickness.

Chuck another piece of wood about $2\frac{1}{2}$ in. sq., and turn down to $2\frac{1}{4}$ in. diameter Reduce the end to $1\frac{3}{4}$ in. diameter, for a length of 1 in. and part off so that the large diameter is $1\frac{3}{4}$ in. long. Gripping the small diameter end in the machine vice of the vertical slide or in the toolpost—you can cut flats on the last $\frac{3}{4}$ in. of it for better grip—fly cut the end to a radius of $1\frac{3}{8}$ in. Glue this centrally on the body and at right-angles to the centre-line of the lug. For the clamping-screw lugs cut lengths of $\frac{3}{4}$ in. dowelling, and plane a flat on one side, chisel corresponding flats on the

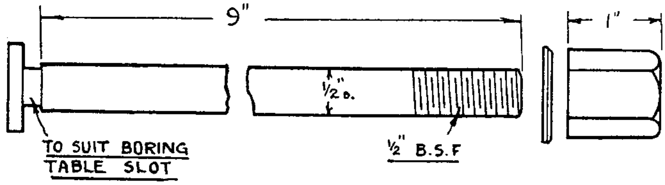


Fig. 9. *The pillar clamping-bolt*

The Clamping Bolt (4)

Fig. 9 shows this; it is a $\frac{1}{2}$-in. B.S.F. bolt $9\frac{1}{4}$ in. long, with a special long nut made to fit it. The head of the bolt is turned down and filed, to suit the boring table slots.

The Carriage (5)

Fig. 10 shows the pattern for this part.

Commence by cutting a 7 in. length of 3 in. × 3 in. material and mount between centres as for the pillar. Turn to a little above $2\frac{3}{4}$ in. diameter

body of the carriage in the correct position, and glue the dowel pieces to these, taking care that they are truly positioned as shown in the drawing. Fill up joints and build up fillets where necessary with plastic wood. Add draft as shown.

Fig. 11 shows details of the carriage. Chuck the casting in the four-jaw as shown in photograph No. 12—a 6 in. chuck would be better if you have one—and adjust so that the outside of the body runs as truly as possible, with the sides parallel to the lathe bed.

Bore to a nice sliding fit on the pillar, taking great care to get as smooth a finish as possible because it will be used "as bored," a lap of the

*Continued from page 686, "M.E.," November 22, 1951.

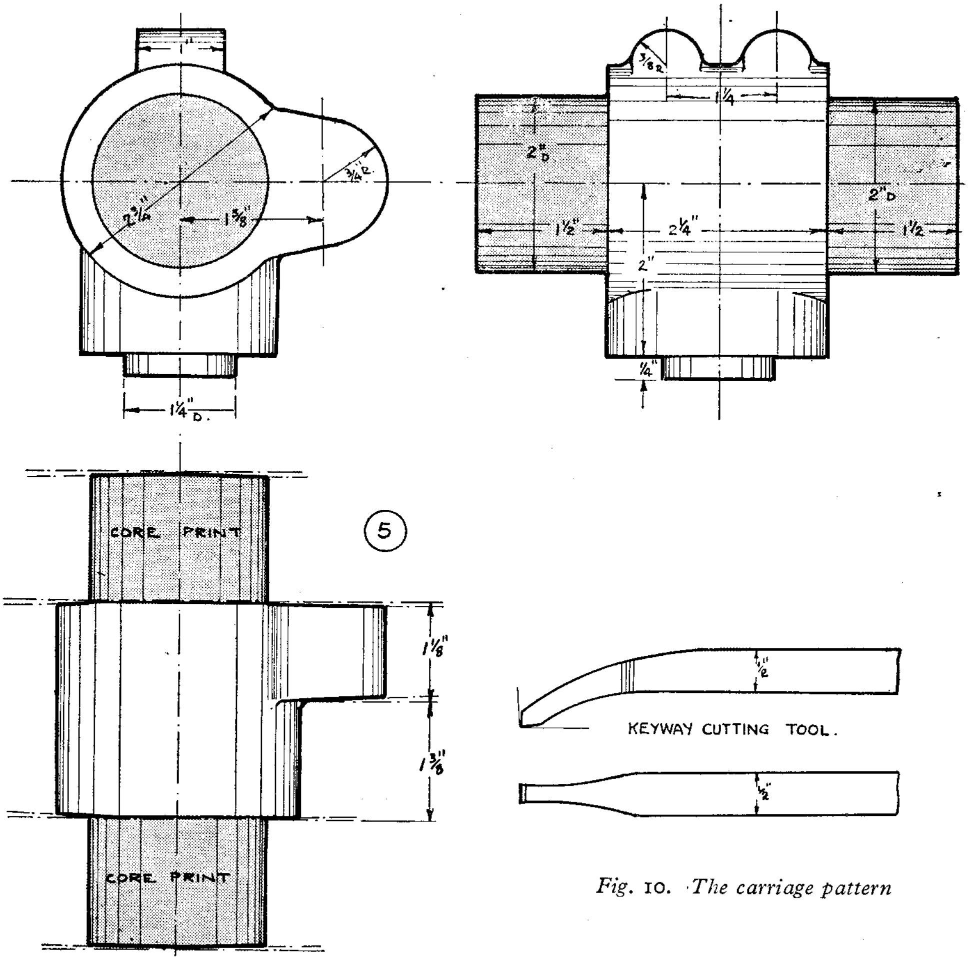
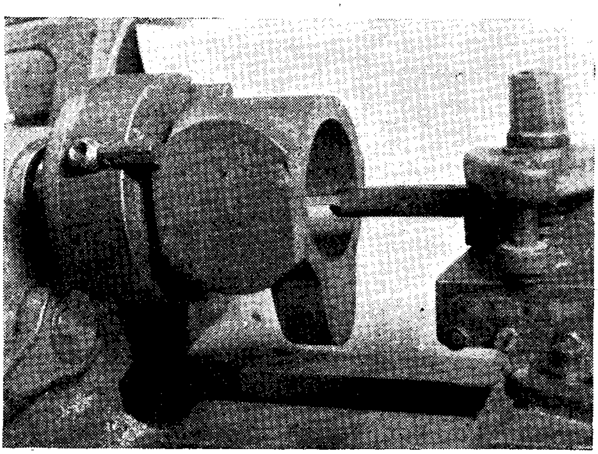


Fig. 10. The carriage pattern

size necessary would be quite a big job, and I hardly think it worth while. Face the end, and then cut the keyway.

When cutting internal keyways it is usually found best to draw the cutter through the work; it is not easy to arrange to do this with such a large casting, but if a stout tool is forged and sharpened as shown in Fig. 10, no difficulty should be experienced, but it will be found easier if a small chamfer is filed to start the tool, and if only the skin of the casting was removed when taking the facing cut, this chamfer can be removed when turning the body down to size. Clamp the mandrel in the same way as described when cutting the keyway in the pillar, and position the casting so that the keyway comes centrally under the circular boss, and at right-angles to the lug, then cut the keyway as previously described, taking



Photograph No. 12. Cutting the keyway in the carriage great care that the fit is perfect.

All parts are now assembled as far as possible, and bolted to the vertical slide, or to a large angle-plate fixed to the cross-slide.

A ¼-in. drill is fitted in the drill chuck of the headstock, and the hole already drilled in the top plate lug brought into line with the drill which is entered into the hole, taking care that it is truly in line; in fact, it is as well to line the hole up on a centre drill first. Now bring the carriage up to the top plate, and place a piece of wood between the lug and the vertical slide to prevent it moving back, as shown in photograph No. 13, then drill right through the lug of the carriage with the ¼-in. drill.

With a large centre drill, chamfer the hole to almost ⅜-in. diameter and then drill right through with a size U and reamer ⅜ in. Remove the

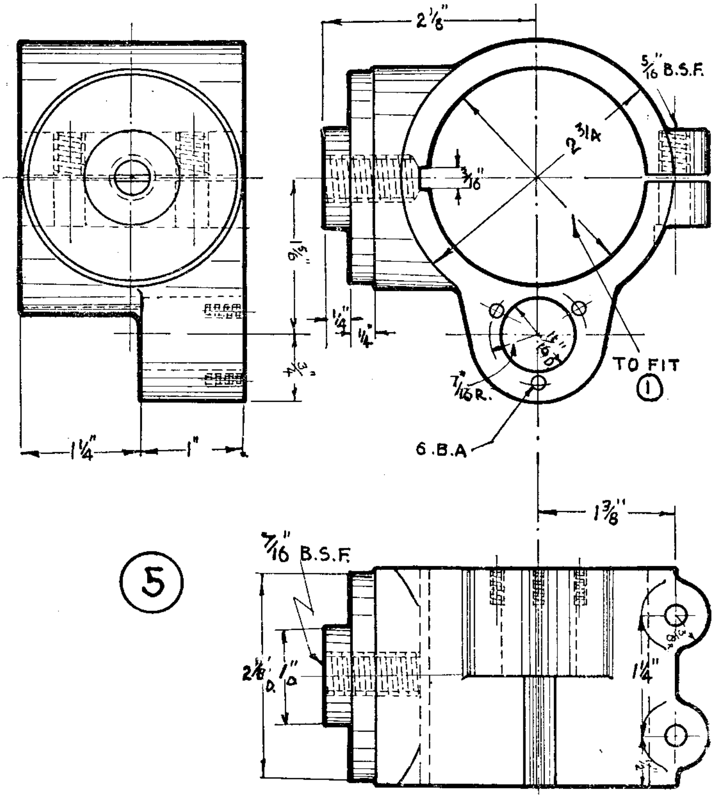
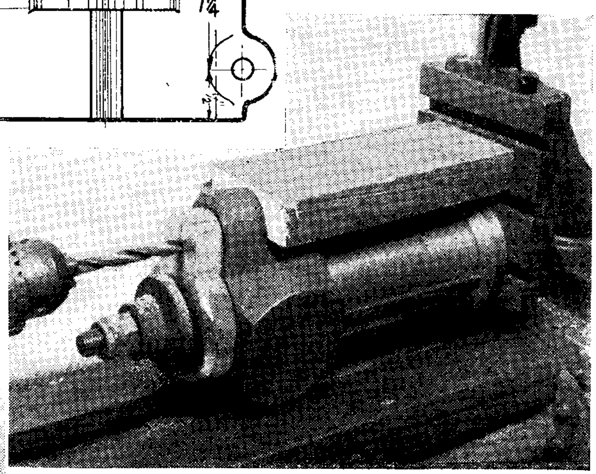
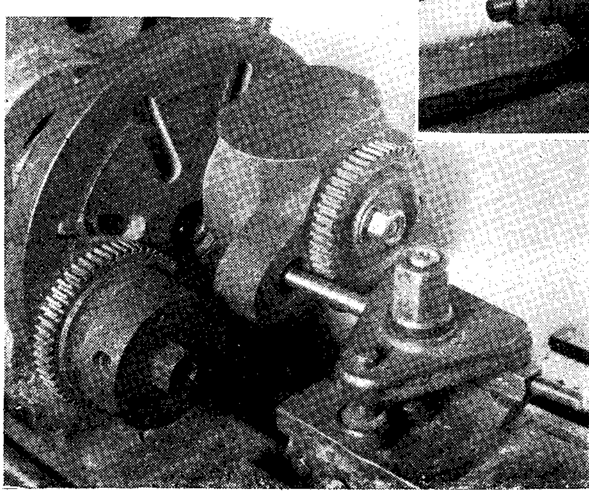


Fig. 11. *The carriage*



Photograph No. 13. *Drilling the pilot hole for the feed screw nut housing in the carriage*

Below—Photograph No. 14. *Boring the hole for the feed screw nut*



carriage and mount it on the face plate as shown in photograph No. 14, push a short length of ⅜-in. rod into the hole just drilled and set to run truly with the dial indicator.

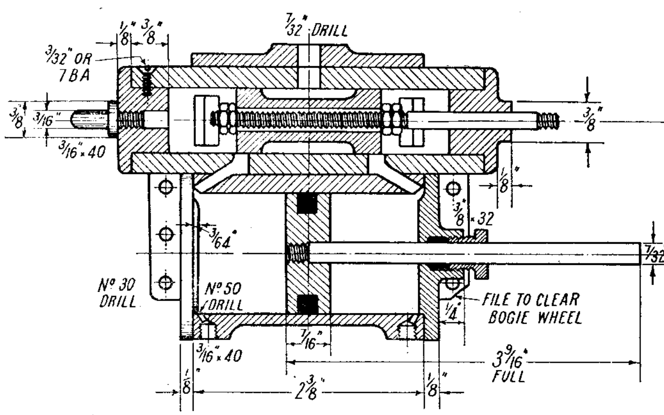
(*To be continued*)

"Britannia" in $3\frac{1}{2}$-in. Gauge

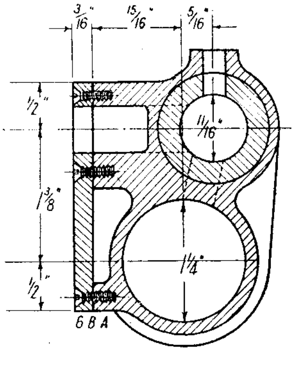
by "L.B.S.C."

Constructing the Cylinders

THE cylinders for our little "class 7" are of the genuine piston-valve pattern, and are of "scale" bore and stroke, viz. $1\frac{1}{4}$ in. × $1\frac{3}{4}$ in., with piston-valves $\frac{11}{16}$ in. in diameter. I couldn't resist a chuckle when making the drawing of them, as the piston-valves are jolly near as big as the *cylinder bores* which were thought to be suitable for a $3\frac{1}{2}$-in. gauge engine in the days before the Live Steam notes came into being. There are still a few die-hards who believe in the old "scale equals bore" ratio, if you ever heard of such tommy-rot! As for fitting piston-valves, the very mention of them would cause the said die-hards to faint—thank goodness we know better now! Whilst the cylinders are generally similar to those I specified for *Doris* and *Pamela*, and which have proved very successful, there are a few differences in detail, the chief of which is the means of attachment to the frame. Instead of being fixed direct, by screws or studs, to the frame, a plate is screwed to the bolting face, and this extends beyond the cylinder castings at each end, like the bolting flanges on the cylinders of the full-sized engines. These flanges carry the fixing bolts. The guide-bars are not attached to the cylinder covers in any way, thus enabling the back covers to be machined all over. The liners in which the piston-valves work, are of my usual pattern, and are turned to a press fit. The steam ways are short and direct, avoiding waste of steam. No valve spindle guides are specified, as they are unnecessary in this size of locomotive; but if anybody wishes to fit them for appearance sake, there is not the slightest objection. I'm not fitting them on my own engine; time available now is barely enough for absolute essentials.



Section of cylinder



Cross section of cylinder

Boring and Facing Job

If the lathe faceplate is big enough, the easiest and quickest way to bore and face the castings, is to mount them on an angle-plate attached to the faceplate, and use an ordinary boring tool operated either by the self-acting feed of a screw-cutting lathe, or by the top-slide of a plain lathe. This is the method I use myself. The faceplate of my type R Milnes lathe is 9 in. diameter; and all I had to do, was to bolt a No. 2 Keats angle-plate to it, drop the casting into the V, tighten the clamp, adjust the angle-plate on the faceplate until the corehole for the main bore ran truly, tighten the angle-plate on the faceplate, face off the end of the casting, and put the boring tool through (a Rennite tipped tool) by aid of the self-act. Money for jam, says you! The job can be done in much the same way on a $3\frac{1}{2}$-in. Drummond, Myford M.L.7, or any similar-sized machine. To bore the hole for the piston-valve liner, the bolts holding the angle-plate to the faceplate were slacked off, and the angle-plate moved bodily on the faceplate until the other corehole ran truly; the boring process was then repeated, using a bit of $1\frac{1}{8}$ in. round steel as a gauge, instead of the inside jaws of a slide gauge. It's easier and quicker!

If a Keats angle-plate isn't available, an ordinary one will do; the only thing is, that it takes longer to set up the job. Smooth off the bolting face of the casting with a file, also one end; then check off the location of the core-holes. I've only seen two of our advertisers' castings so far (Wilwau and Reeves) but on both of these, the core-holes were pretty accurate, as to position. If the core-holes are out of place, plug the ends with bits of wood, mark the correct centres of cylinder bore and liner bore on the plugs, and use the marks as centres from which you can scribe the location of the bores correctly, using a pair of dividers. Bolt the angle-plate to the faceplate, and put the casting on it, with the bolting face down. Set the casting parallel to the lathe centre-line by aid of a try-square, stock against the faceplate, and blade against the casting. Clamp the casting to the angle-plate by a bar across its back, with a bolt at each end to hold it down. Then adjust the angle-plate on the faceplate until the core-hole, or the scribed circle, as the case may be, runs truly, and tighten the bolts well. If the angle-plate slips, you've had it, as they say in the R.A.F. Bolt a balance-weight opposite to the angle-plate to prevent vibration.

If locating by the core-holes, face off the end of the casting with a round-nose tool set crosswise in the rest; but if you are locating by scribed circles, leave the facing till afterwards, or you'll wipe out the circle showing the bore for the liner. Then go ahead and bore, using the stiffest possible tool. I have two Rennite tools, and two Ardaloy, and they go through hard casting skins like a hot knife through a pat of butter, the shanks being stiff enough to prevent springing. The first cut should be deep enough to clear out all the roughness, and it doesn't matter if the tool does spring a little, and "cuts rough," as long as it cleans out the hole. I use the self-act with a feed of 120 per inch, and it does the job fine. If your lathe hasn't any self-act, the top-slide must be set truly parallel to the lathe centres before setting up the cylinder castings for boring. This can be done in a few minutes, by putting a bit of rod about $\frac{3}{4}$ in. diameter or larger, in the three-jaw, and taking a very slight cut along it, with an ordinary round-nose tool, for a full 2 in. length. Then gauge both ends of the cut with either a micrometer or calipers. If the "mike" readings don't correspond, or if there is any appreciable difference in the feel of the calipers, adjust the top-slide, and take another very slight cut along. About three shots should do the trick. When feeding a boring tool with the top-slide, aim to turn the handle slowly and evenly; the even turning movement is essential, because it keeps the pressure constant on the tool edge, and ensures an even cut, and consequently a true bore.

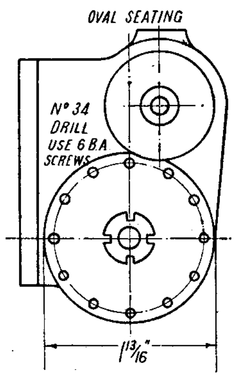
I went into the question of cylinder boring pretty thoroughly, in the description of *Tich*, and the "technique" for those small cylinders applies equally to the larger ones for *Britannia*. If you are the lucky owner of a $1\frac{1}{4}$-in. parallel reamer, bore out the casting until the "lead" of the reamer will enter almost to the parallel part; inexperienced workers should bear in mind that a reamer is a finishing and sizing tool only, and *not* a boring tool. If you haven't a reamer, bore to finished size, using a piece of $1\frac{1}{4}$ in. diameter round rod as a gauge. A stub end of shafting does well for this. When the hole is to size, run the boring tool through about three times, without shifting the adjustment of the corss-slide; this should result in a very true and smooth bore. I did *Jeanie Deans's* big low-pressure cylinder that way, and it came out dead parallel and as smooth as glass.

When the main bore is finished, slack the bolts holding the angle-plate to the faceplate, adjust the angle-plate until the core-hole or scribed circle for the liner bore runs truly, retighten, and ditto repeato the boring tactics. This ensures that both the bores are absolutely parallel. If you shift the cylinder casting on the angle-plate, the odds are a million dollars to a pinch of snuff that you'll never reset it truly. If you haven't already done so, measure the length of the casting and subtract $2\frac{3}{8}$ in. from it; face off half the difference from the end of the block. Mine measured $2\frac{1}{2}$ in., so I had to take $\frac{1}{16}$ in. off each end. The second end was faced off with the casting on a stub mandrel (piece of brass rod turned to a tight fit in the bore) held in the three-jaw. Be mighty careful when taking the first "rough skin" cut off the second end; as the cut is "hit-and-miss" for part of the revolution, too "greedy" a cut will knock the point off the tool, and maybe damage the casting.

Reaming

I don't suppose that many builders of this engine, in home workshops, have a lathe with a hole in the mandrel nose, big enough to allow the end of a $1\frac{1}{4}$-in. parallel reamer to enter; but if there are any, you can poke the reamer through the main bore before moving the angle-plate for the steam chest boring. Just put a carrier on the shank of the reamer, hold it with the centre point of the tailstock in the centre hole that you'll find in the middle of the squared end of the reamer, enter the "lead" end in the bore, and push the reamer through, with the lathe running slowly, by pushing the tailstock bodily along the lathe bed. *Don't stop*; the only pause should be for reversing, otherwise you'll find rings in the bore. Feeding with the hand wheel also produces rings. If you have a hand rest, mount it on the bed (or saddle, as the case may be) and let the tail of the carrier slide along it, which will relieve your wrist of all the anti-turning strain. A few drops of cutting oil on the reamer, helps matters a lot. The text-books say that non-ferrous metals, like bronze, gunmetal, etc., should be worked dry; but my own experience is, that text-books aren't always right, and some of the writers of them are more theoretical than practical. Experience still teaches; it has taught me a lot, anyway!

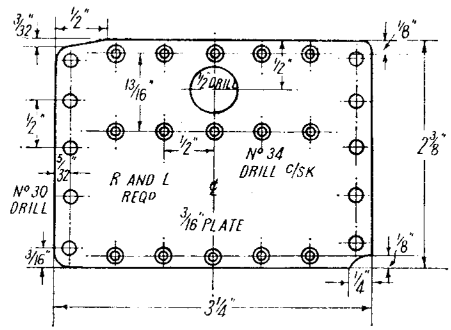
I have reamed a good many cylinders by hand, in the following way. The casting was held level in the bench vice, and a hefty tap-wrench clamped on the squared end of the reamer. The "lead" end was entered in the bore, and the reamer fed in as the tap-wrench was slowly turned. When hand reaming, it doesn't matter about stopping the feed, as the cut stops at the same time; natural, of course, as you have to stop turning, to take a fresh grip of the tap-wrench, and avoid converting your arms into a corkscrew. Whether hand or machine reaming, it is advisable to rub an oilstone along the cutting edges of the reamer, to smooth off any slight jags; a very small one will produce a ringed bore. If you are unlucky, and find a ring, the best way to get rid of it is by lapping, as I described for *Tich*, viz. making an improvised lap by wrapping a piece of fine emery-cloth or other abrasive, around a piece of wood, until it just fits the bore loosely; hold it in the three-jaw, put the cylinder on it, run the lathe as fast as possible, and move the cylinder up and down the lap, letting it "float" in your hand. I'm quite aware that Inspector Meticulous frowns severely on such antics; but they do the trick! However, the great thing is, to avoid rings—prevention was always better than cure! Incidentally, if you get ring marks in the steam chest bore, don't worry, just let them be. They won't affect the fitting of the liner one iota.



Back of right-hand cylinder

How to Machine Bolting Faces

The easiest way of machining the bolting faces is to up-end the casting on an angle-plate attached to the faceplate, and secure it by a bolt through the main bore, using a big washer under the bolt-head; then face off in the usual way. On small lathes, it would be advisable to put a bolt through each bore, and make absolutely certain that the casting doesn't shift, as the cut is intermittent. The knock on the casting, as each corner of the rectangular surface hits the tool, will shift it almost imperceptibly on the angle-plate if the casting isn't rock-solid, and the result will be an untrue surface. Before setting up the job, make a mark on one end of the casting, indicating the exact amount to be faced off. The distance from the edge of the main bore to the bolting face is $\frac{5}{16}$ in.; and from the edge of the steam chest bore, it is $\frac{11}{16}$ in. If these distances are not right, the offset of the steamchest bore will be incorrect, and this in turn will upset the valve-gear. The way I personally do it, is to measure from the two bores, and then scribe a good deep scratch on the machined end of the casting, which will be at the top, when the casting is mounted on the angle-plate. The latter job being done, the angle-plate is bolted to the faceplate, so that the casting is as near central as possible, a small weight (a change-wheel, or anything else that happens to be handy) being attached opposite to the angle-plate, to balance it. The scribed line is then set parallel to the faceplate; Inspector Meticulous would pass clean out if he saw me do it with two try-squares! I just hold the stocks together, put one blade against the faceplate, and the other against the casting, setting the

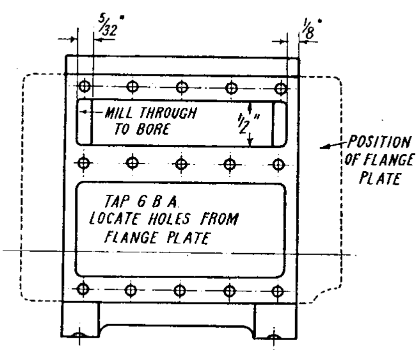


Flange plate

scribed line to the latter blade. The clamp-bolt is then tightened, and the casting faced with a round-nose tool set crosswise in the rest, until I cut into the scribed line. I can set the job up in much less time than it takes to write the instructions. The scribed line is visible all the time the work is revolving; if you don't believe me, just try for yourself—seeing is believing!

Steam and Exhaust Ways

The steam ways are drilled in much the same way as those on the cylinders for *Doris* and *Pamela*. There are no ports to cut; and it doesn't matter, within reason, of course, about the upper ends being "spot on" where they enter the steamchest bore, as the clearances on



Bolting face of cylinder

the liners can be filed to suit. File a bevel on the lip of the main bore, at the point indicated by the dotted lines in the cross section; this should be about $\frac{5}{16}$ in. long and $\frac{1}{8}$ in. wide. Make two centre-pops on it $\frac{3}{16}$ in. apart; and from these, drill $\frac{1}{8}$-in. holes into the liner bore, at an angle of about 30 deg. to the main bore, see longitudinal section. This can be done on a drilling machine,

(*Continued on page* 713)

PETROL ENGINE TOPICS

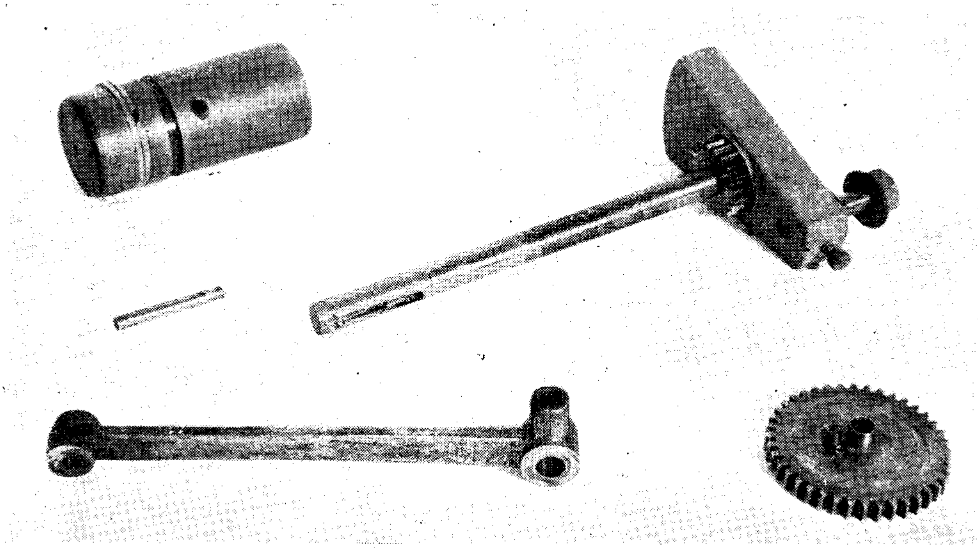
*"New Engines for Old!"

How an Ancient Gas Engine was Improved, Modernised, and Given a New Lease of Life

by Edgar T. Westbury

ALTHOUGH one or two important machining operations remained to be done on the awkwardly-shaped body casting, it was decided to leave it for the time being until the main mechanical working parts had been settled. As the original crankshaft, connecting-rod and timing gears had definitely been consigned to the scrap heap, new and considerably modified components were sketched out and put into construction right away.

The old crank web looked more like the week's cheese ration than a well-designed engine component, and I thought that it could at least be made a little better-looking, if nothing else. It was made of cast iron, which is not ideal for this particular purpose, but in view of the difficulty of getting more suitable material in these days of scarcity, it was decided that the same metal could safely be used in the new part, and a simple wood pattern was machined to shape, smoothed down with glass-paper, and given a couple of coats of shellac varnish. Good timber for pattern making is another of the many things "in short supply" these days, but this was not a major worry in the case of a simply shaped part which had to be machined practically all over. Our old friend, Mr. W. H. Haselgrove, supplied a casting from the pattern in an excellent quality close-grained iron, which machined up nicely, and has served its purpose quite well.



Some of the original components: piston, gudgeon-pin, crankshaft, connecting-rod, and timing gears

In the meanwhile, the bearing housing was fitted with bushes turned from solid cast bronze stick, each $1\frac{1}{4}$ in. long and pressed in from either end to an interference of 0.001 in. It would have been desirable to make these bushes with a flange at the outer end, but unfortunately space was rather tight, especially at the crank end, and so plain parallel bushes were made and pressed in flush with the ends of the housing, using a long bolt to provide the necessary "draw-bar pull." In the absence of a reamer to line-ream the bushes after insertion, they were lightly lapped with a $\frac{5}{8}$-in. aluminium rod just to make sure there were no serious high spots to interfere with continuity of bearing surface.

The web casting was of a convenient shape to enable it to be held in the three-jaw chuck for

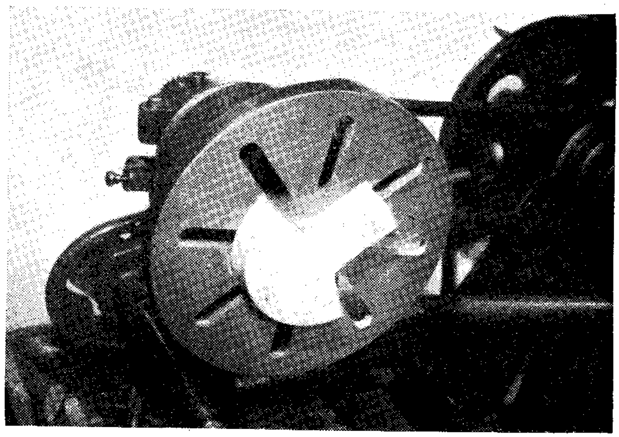
*Continued from page 658, "M.E.," November 15, 1951.

facing the two sides and, at the same settings, it was possible to rough machine the outer edges as well. It was not taken down to finished size on any of these surfaces, as the main object at this stage was to obtain parallel faces ; the finishing could most conveniently be carried out after mounting on the shaft. The centre was then drilled, bored out to a 10 deg. taper, with great care to ensure a smooth and accurate finish, and recessed on the other side. It may be remarked that the length of the tapered bore is not so great as might be wished to ensure a really good seating for the shaft, but it could not be increased on account of the limitation of the distance from the centre-line of the cylinder to the end face of the main bearing, which had to include half the length of the crankpin, the thickness of the crank web, and the face width of the timing pinion.

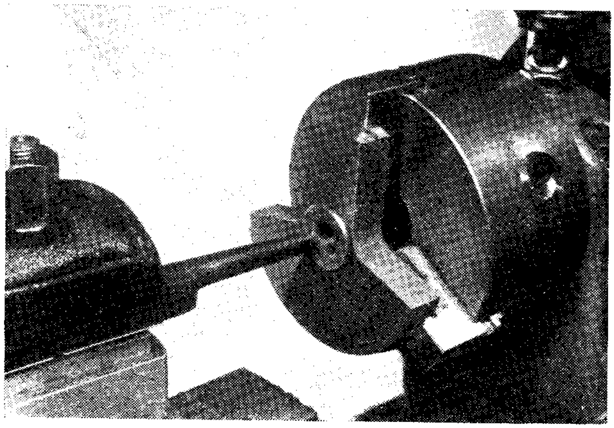
After facing and boring, the web was marked out to indicate the radius of the crankpin, by using a point tool to incise an arc on the face. It may here be remarked that when marking out a radius in this way, it is desirable, wherever possible, to strike the arc on both sides of the centre, that is, on both the web and the balance weight in this case. In this way, it is possible to check with dividers the *diametral* dimension instead of the radius, and thereby halve the margin of visual error. Indeed, when the centre is hollow, as in this case, it is often difficult to get accurate measurement in any other way.

The casting was then set up on the faceplate, with its centre eccentrically offset to bring the crankpin centre in position for boring ; it was clamped by two Myford slotted toe-clamps as shown, and balanced by a couple of change wheels. Incidentally, the use of change wheels for this purpose has been criticised, as some readers consider that they should be tenderly preserved except when required for the intended duty ; but it does them no harm if due care is exercised—and have you ever considered how handy it is to have a full set of graded " weights " available for balancing jobs at a moment's notice ? By all means use scrap lumps of metal if you have them—but how many of us have such a really well-equipped scrap box that we can rely on picking up just the right weight of metal for the job in hand ?

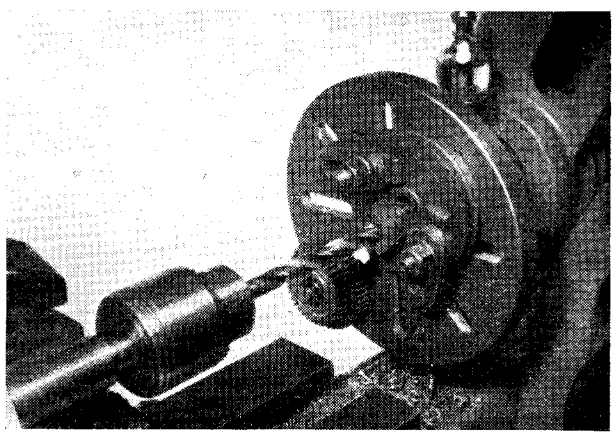
In boring the crankpin seating, care was taken to obtain a smooth and accurate finish, as the crankpin



Machining the pattern for the new crank web

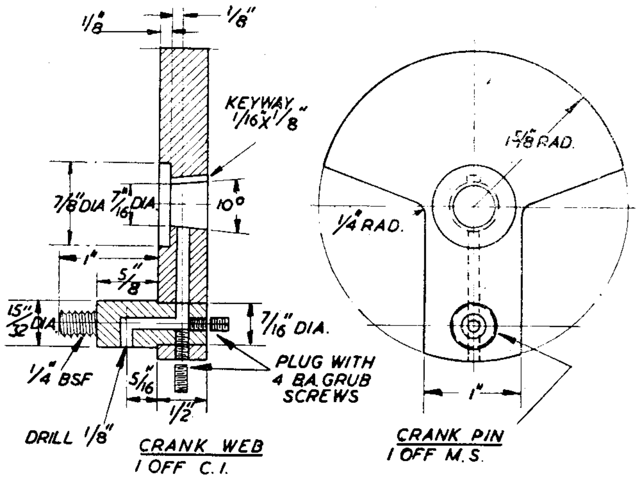


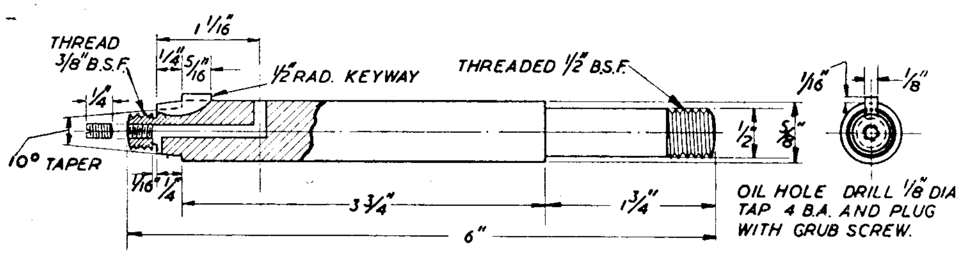
Boring the tapered shaft seating in the crank web

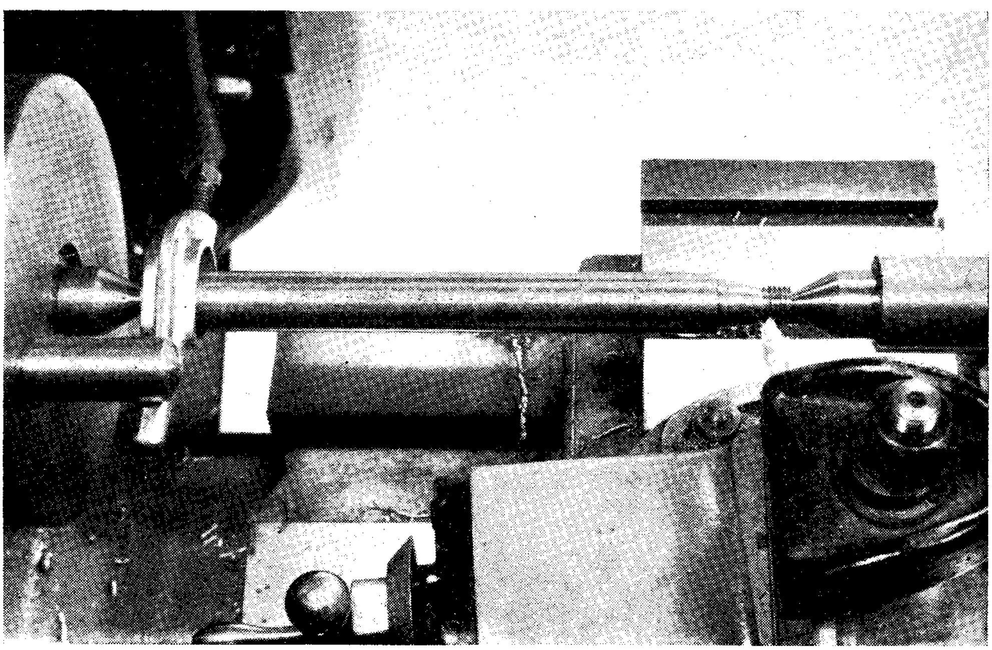


Crank web mounted eccentrically on faceplate for drilling and boring crankpin seating is fitted by pressing in, and in view of the relatively low tensile strength of cast-iron, it is not safe to allow more than about 0.0005 in. interference here, so that the highest possible surface accuracy of both parts is essential, to avoid risk of working loose after fitting. As the late Mr. Henry Greenly pointed out, in respect of the fitting of locomotive wheels, quite a light interference fit will suffice if the surfaces are both well finished, so that they bear over their entire surface, and not merely on high spots. A very slight countersink or chamfer was machined on both ends of the bore.

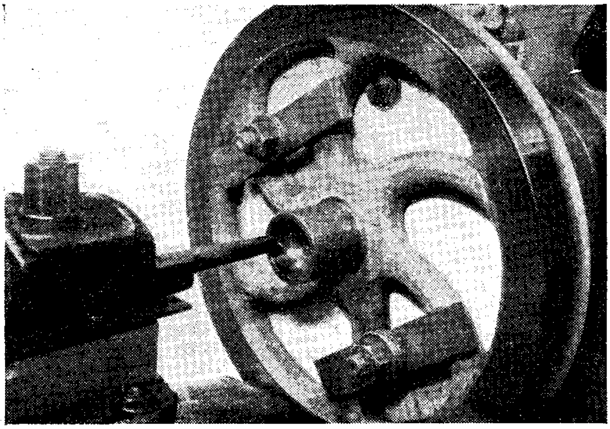
The shaft journal was a fairly straightforward "between-centres" job, which calls for little comment, except to note that the fitting of the taper







Crankshaft journal set between centres for taper turning and screwcutting at crank web end


Taper boring and recessing flywheel

for the crank web had to be very carefully carried out, and the use of blue marking paste enabled the tapers to be accurately matched. It will be noted that there is a shoulder at the back of the taper, and the position of this was arranged so that when the web was wrung on as tightly as possible by hand, about 0.010 in. clearance was left at this point. When drawn up tightly by the crankshaft nut, however, the surfaces just made contact, increasing the seating area and giving definite end location. After all turning operations on the shaft were completed, the end was drilled to form an oil passage and tapped for a 4-B.A. grub screw. The journal surface was lapped to a smooth working fit in the main bearing bushes, leaving a "land" behind the crank web to take the timing pinion, which was made a light press fit.

Before fitting the crankpin, the crank web was temporarily mounted on the shaft and secured by its nut, in order to finish machining of the front face, as this cannot conveniently be reached afterwards. Incidentally, the thickness of the shaft nut, and the projection of the screwed end of the shaft, is strictly limited by the necessity of clearing the connecting-rod, but by care in the screwcutting of the thread, and the use of an aircraft quality B.S.F. nut, suitably reduced in thickness, a perfectly secure fitting was obtained.

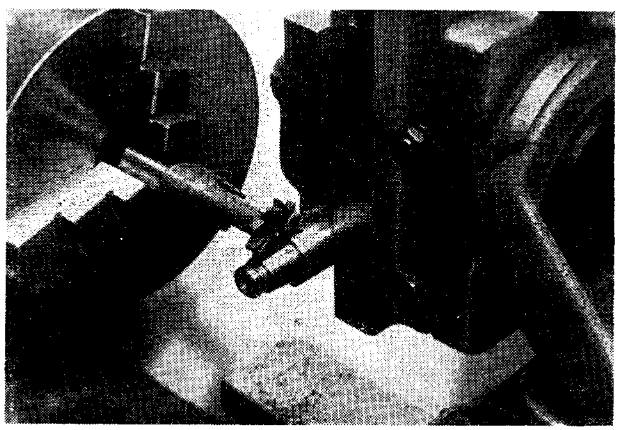
The crankpin was made from a short piece of high tensile steel which happened to be available. Mild-steel would have been mechanically strong enough, but the harder surface was considered better for avoiding any tendency of the highly loaded bearing to become scored in the course of wear, possibly under conditions of rather inadequate lubrication. As shown, it was drilled and tapped to form oil passages. The seating end was left 1/32 in. longer than the thickness of the web, and after pressing in the pin, using the bench vice as a press, it was lightly riveted over into the countersink, with the idea of inhibiting any tendency of working endwise under load.

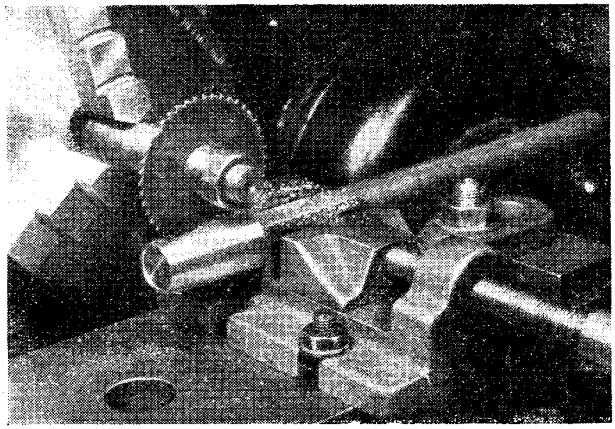
To ensure positive rotational location of the crank web, a keyway was cut in both the web and the shaft, the former being carried out by a planing method, as recently described for the "Busy Bee" engine, and the latter by means of a slotting cutter in the lathe chuck, with the shaft mounted on the vertical slide, as shown. The key is stepped, as will be seen from the detail drawing of the shaft, the rear portion being used to locate the timing pinion, and the front to locate the crank web. It is important, in both cases, that the key should be a good fit in the sides of the keyway, but clearance should be allowed over the top, so that it cannot in any circumstances tend to force the parts out of truth. The keyway in the crank web should preferably be set at 180 deg. to the crankpin, where it is least likely to produce bursting stress in the web under heavy torque load.

Finally, the assembled shaft was run between centres for finishing the outer edge and back face of the web, including the facing of the riveted end of the crankpin, flush with the web surface. The drilling of the oil ways was completed, with cross-holes in the journal and crankpin, and a radial hole down through the web and into the shaft, tight grub screws being fitted where required to close the unwanted holes.

Flywheel

It was, of course, essential to re-seat the flywheel, which entailed the necessity of boring it out large enough to remove the remains of the endwise hole originally drilled to take the round key. While it would have been possible to fit the flywheel on a parallel extension of the shaft, using the slightly tapered "stake" key which was common practice on stationary gas engines, it was considered that a much safer and sounder job would result from using a tapered


Cutting the keyway in crankshaft



Slitting flywheel collet

fitting, such as I have always recommended for petrol engines of all types. The flywheel was therefore bored out to take a split taper collet, which in turn was mounted on the parallel extension of the crankshaft.

In order to bore the flywheel, it had to be mounted on the faceplate, and here a difficulty arose, as the latter was not large enough to allow the flywheel rim to bed against it, and the rough surface of the spokes did not present a true or adequate bearing to hold it securely. A false wooden disc was therefore turned up *in situ*, and the flywheel secured to it by two bolts and straps between the spokes.

It will be seen that the flywheel casting has an integral extended boss, which is no doubt intended to form a small driving pulley for flat belt. This was useful, in extending the length of the flywheel seating, and also allowing the draw nut to be sunk out of the way, but in another respect it increased the machining problem, as the flywheel could only be mounted one way round, and in consequence the taper boring had to be done from the small end, which is not very convenient. Besides recessing and taper boring, the rim and outer edge of the flywheel were trued up at the same setting; the back of the rim, being bedded against the trued-up wooden disc did not need re-maching.

The collet was turned from a piece of bar, allowing sufficient chucking length for it to be machined inside and out at one setting, and after parting off, it was pressed on a mandrel to enable it to be slit with a small circular saw, the mandrel being held in the Myford machine vice, which was mounted on the lathe cross-slide. It may be mentioned that the first collet was made in mild steel, but for some unknown reason a spot of bother arose, causing the shaft to become scored, and the collet distorted. A brass collet was afterwards made, to avoid this possibility, and so far, no further trouble in this respect has arisen.

(*To be continued*)

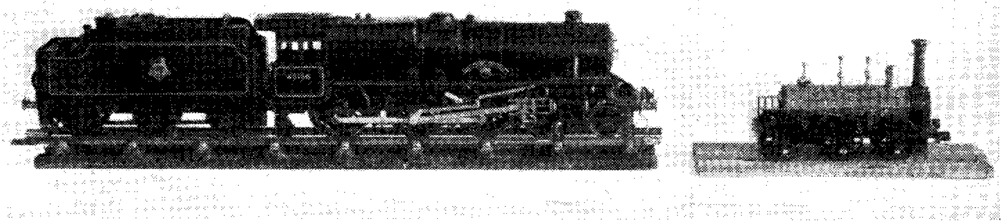
"L.B.S.C."

(*Continued from page* 708)

as fully described in the notes about the *Tich* cylinders; but a simpler and quicker way would be to put the casting in the bench vice, tilting it down to the required angle, and drill the holes by hand, holding the drill brace horizontally. There is only about ¼ in. of metal to go through—a far different proposition from drilling the steam ways from the ends of the bore, to the ports of a slide-valve cylinder. When the holes are drilled, run them into a slot with a rat-tail file. The resulting oval hole will pass all the steam needed by the engine under any condition of working, but won't be big enough to waste any.

The exhaust ways are two slots 5/32 in. wide and ½ in. long, forming communication between the liner bore and the upper recess in the bolting face of the casting. They can be milled in exactly the same way as I have described for machining the ports of a slide-valve cylinder, viz. up-ending the casting on an angle-plate attached to a vertical slide, and cutting the slots with an end-mill or slot-drill in the three-jaw. Alternatively, the casting can be mounted on the top-slide, under the tool holder, packed up to the correct height for the slot-drill to cut the opening in the right place. I do mine on a vertical milling machine, holding the casting, bolting face up, in the machine-vice on the table of the machine, and operating with a home-made slot-drill in the chuck on the miller spindle. The table can be adjusted, by the longitudinal and cross feeds, to bring the casting exactly right for cutting the slots.

The job can also be easily done by hand. All that is necessary, is to drill three 5/32-in. holes, one above the other, at each end of the recess in the casting, and remove the metal between the holes with a rat-tail file. Some folk like to drill the steam and exhaust ways from the solid; others prefer them cast in, where such is possible, to minimise work. There are arguments pro and con; take your choice, as Reeves supplies cylinder castings for drilling, whilst Wilwau supplies them with the holes already there! Next stage, liners and valves; meantime, anybody hard up for a job, can get on with the pistons and covers, using the *Tich* notes if they need any guidance.



Mr. G. A. Lord's " O " gauge L.M.S. 4-6-0 alongside Mr. E. Wood's "O " gauge Leicester & Swannington Railway 0-6-0 " Atlas "

GRANTHAM'S 1951 EXHIBITION

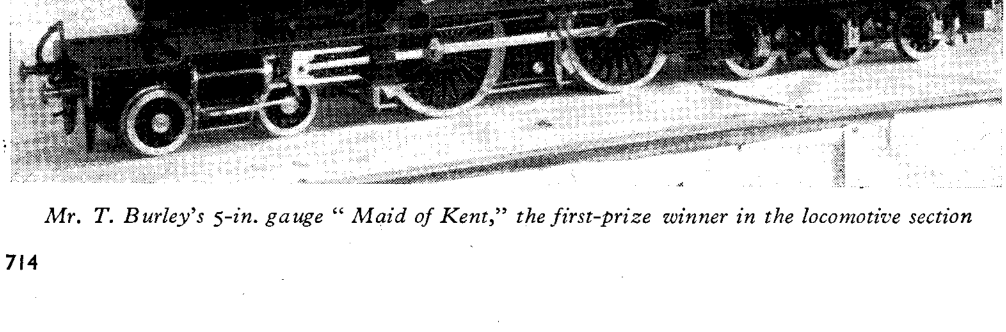
THE third annual exhibition by the Grantham S.M.E. was opened in the Guildhall, Grantham, by His Worship the Mayor of Grantham (Ald. W. Goodliff, J.P.). After the opening speeches, His Worship operated the controls to despatch the first train on the " OO " gauge layout which formed the centrepiece of the show.

Since the 1950 exhibition, the local Model Aircraft Group has been absorbed into the society, and aircraft entries were consequently more numerous than in previous years. A number of entries were received from R.A.F. personnel serving on nearby stations. First prize went to A. Holden for a radio-controlled high-wing monoplane, and second to B. R. Newman (R.A.F.).

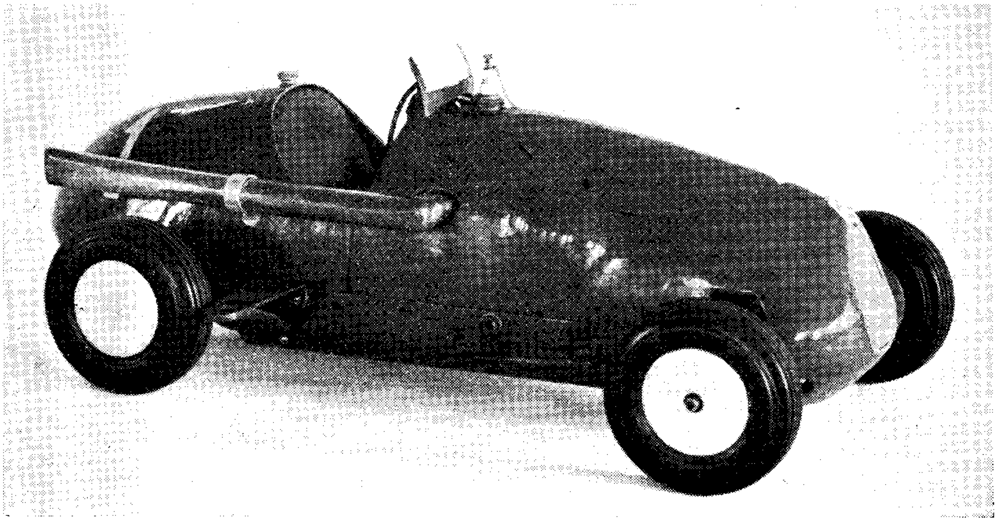
In the locomotive section, the majority of the entries came from Leicester S.M.E. The judges had little hesitation in awarding first prize to the " Maid of Kent," 5-in. gauge 4-4-0 to " L.B.S.C.'s " design. This locomotive, by Mr. T. Burley, an 80-year-old modeller, was not without faults, noticeably the cab roof, and oversize rivets on the tender sides, but the general finish was excellent. Second prize was awarded to J. Storar (Newark) for a " Tich " 0-4-0T, and third to another old friend, Mr. S. Taylor, of Leicester, for his 2½-in. gauge 4-6-0, *Sir Sam Fay*.

There was an unusually large entry in the " O " and " OO " gauge section, partly because of a steady rise in local interest in this field, and partly because of help received from the members of the Leicester Model Railway Group, who sent along some 35 entries. First prize in this section went to G. A. Lord, for his " O " gauge L.M.S. Class 5 4-6-0 *Glasgow Yeomanry*, on which the only discernible blemish was the oversize cross-section of the coupling and connecting-rods. Second award went to a Johnson 4-4-0 in the colours of the former Midland & Great Northern Joint Railway, which was exhibited with a train of three *ex*-G.N.R. six-wheeled coaches. Third came an unusual exhibit, namely, an " O " gauge model of the Leicester & Swannington Railway 0-6-0 *Atlas* of 1842. This was the work of Mr. E. Woods, of Leicester, and was,

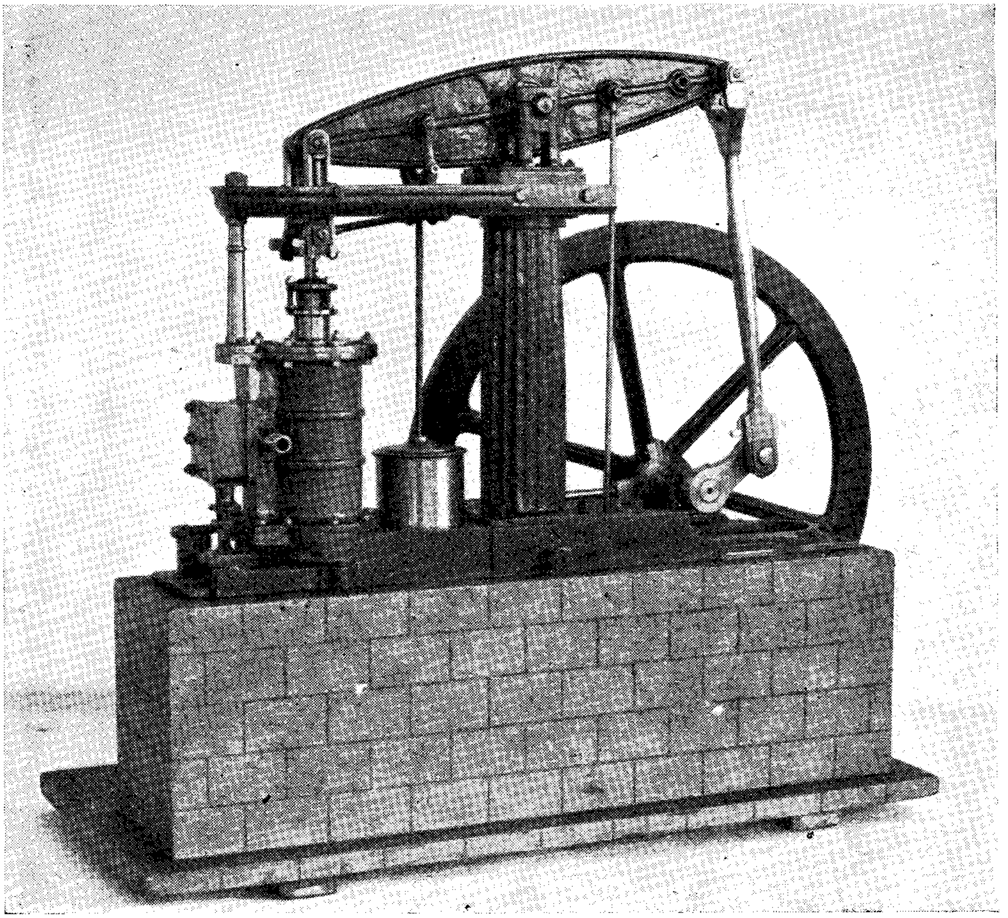
(*Continued on page* 717)



Mr. T. Burley's 5-in. gauge " Maid of Kent," the first-prize winner in the locomotive section



Mr. R. Ebbutt's model racing car, the first-prize winner in the model car section

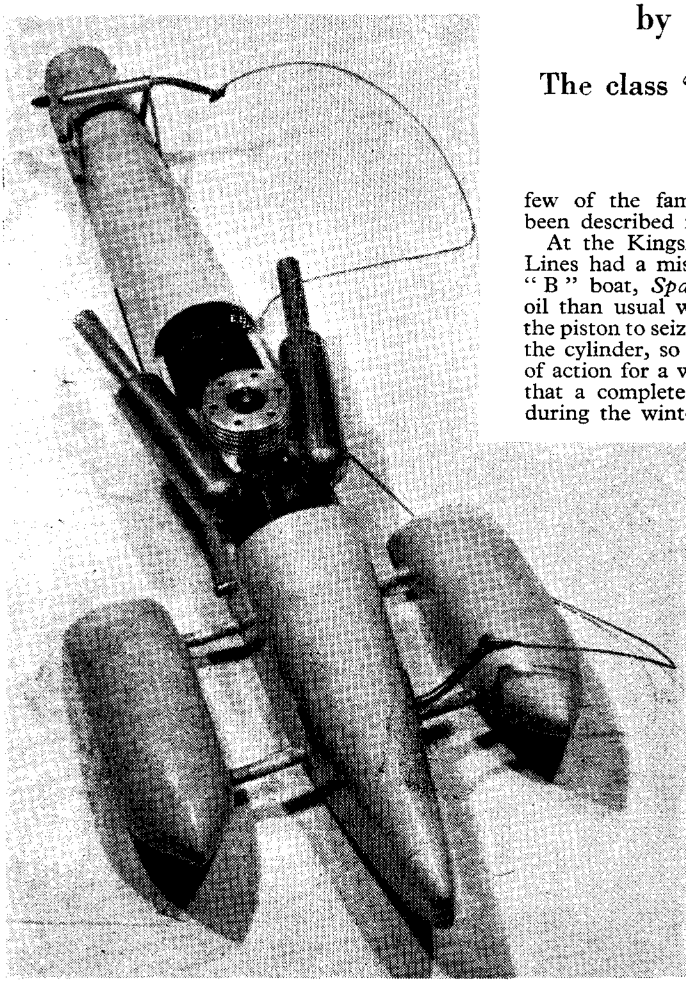


Fred Smith's model beam engine, second-prize winner in the stationary engine section

Model Power Boat News

by "Meridian"

The class "B" Record-holder—*Sparky II*

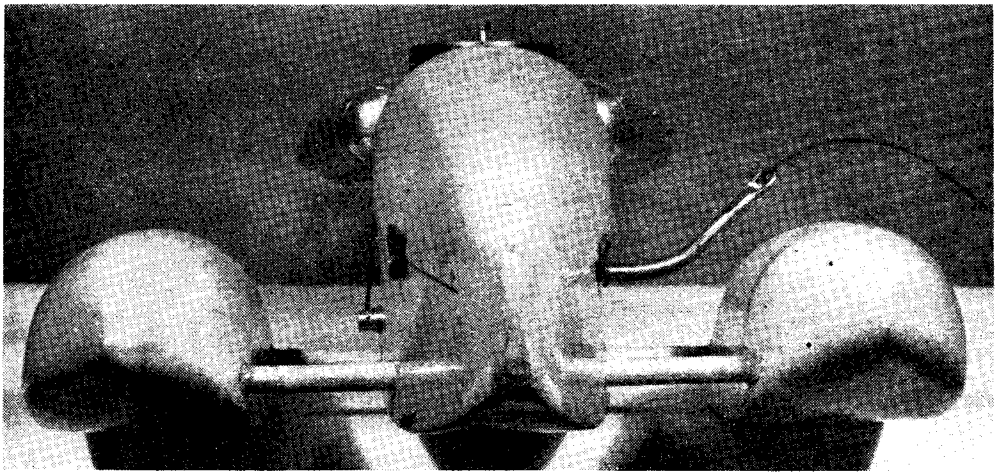


FROM time to time, requests are received asking for information about the leading speed boats, especially for articles describing the construction of both the engines and hulls. The preparation of this type of article, however, does take a considerable amount of time and involves quite a bit of work making drawings, etc. Model speed boat enthusiasts may perhaps be excused for this lack of information, on the grounds that building and running racing boats take up most of their spare time! Nevertheless, in the past the construction of many well-known speed boats has been described in the pages of THE MODEL ENGINEER, and many present enthusiasts were encouraged to make a start after reading about *Chatterbox*, *Faro*, *Tornado III* or the *Ifit* series, to mention only a few of the famous record-breakers that have been described in former times.

At the Kingsmere regatta this year, Mr. G. Lines had a mishap with the well-known Class "B" boat, *Sparky II.* A fuel containing less oil than usual was being tried, and this caused the piston to seize up and break, and also damaged the cylinder, so that the boat is likely to be out of action for a while. In any case, it is possible that a complete new engine may be attempted during the winter. Thanks to the co-operation of Mr. Lines, the construction of *Sparky II* will be described fully in a series of articles. Mr. Lines has made *Sparky II* available for examination, and supplied much information about the construction of both the hull and engine.

Before commencing any constructional details it may not be out of place to give a few notes on the standard of performance of this boat, as shown at the many regattas attended in the past two years. *Sparky II* holds two Class "B" records—300 yds. at 64.6 m.p.h., and 500 yds. at 61 m.p.h., and in addition, this year, has created the unique record of retaining all but one of the many trophies gained during the 1950 racing season. The tophies include the Miniature Speed Championship, the Mears Trophy, the Bedford Cup, the South London Trophy, and the Paten Cup (Wicksteed). The hull has proved to be very stable, and capsizes have been few and far between. On rough water, there is remarkable stability, although, of course, the speed is reduced slightly. There have been several good photographs of *Sparky II* published in THE MODEL ENGINEER during the past two years, and for those who may be considering making a similar hull, reference to some of these may be of help. For the benefit of readers who may not have access to back numbers, two of these photographs are again reproduced.

Referring to these photographs, it may be observed that the hull is quite an unorthodox design, and at recent regattas, hulls have appeared that present a similar appearance. It has to be



The frontal view of " Sparky II "—a fearsome aspect !

recorded, however, that few of these have been quite so successful as *Sparky II*. It appears that the dimensions, weight distribution, etc., are fairly critical.

The objective in the design was to provide a stable hull that would not " flip " at high speeds, and it may be stated that this boat has " flipped " on only a few occasions. The two balsa wood sponsons are fixed to the hull by two ⅜ in. lengths of dowel rod, which fixing has stood up to two seasons' hard work without fracturing. It should be noted that for rough water, Mr. Lines uses some additions, in the form of two light aluminium struts that may be clipped over the dowelling, thus filling in the space between the sponson and the hull. This assists the get-away, but it does increase the air lift of the hull, and they were in use each time *Sparky II* has blotted her copy book by flipping over. The boat is very robust, and no serious attempt has been made to cheesepare in order to reduce weight.

In running order the all-on weight is 7 lb., although originally the weight was around 6½ lb. No doubt a certain amount of water and oil has been absorbed in two seasons of regatta work.

The engine is a two-stroke of 1⅛ in. bore × ⅞ in. stroke, and has a capacity of well under the 15 c.c. limit. It is of the 360 deg. transfer and exhaust type, and is made largely from solid chunks of dural. All things considered, it is a remarkably simple engine, although it should be emphasised that the workmanship is first-class throughout, and the piston fit is of especial importance in this design. This engine must be one of the most powerful 15 c.c. jobs ever made, if one judges by the huge propellers that it quite happily turns over at very high r.p.m.

The next article dealing with *Sparky II* will give full details of the hull, and in the following ones it is proposed to deal with the engine.

(To be continued)

GRANTHAM'S 1951 EXHIBITION

(Continued from page 714)

we understand, the outcome of a period of research at the Leicester Public Library.

The stationary engines illustrated the development of the steam engine during the last 150 years. A number of entries from Mr. Fred Smith, of Pinxton, included two beam engines, a " grass-hopper," and a table engine ; he gained first prize with his horizontal hauling engine, and second with a 1½ in. × 3 in. beam engine.

The ship model section was smaller than usual, but fully representative. First prize was awarded to Mr. Allsopp, of Leicester S.M.E., for his electrically-driven paddle steamer. A special award was given to O. J. Lee, of Grantham, for a ¼-in. scale model of a 25-ton auxiliary sloop. Mr. Lee is an apprentice boat builder, and in this case the model preceded the prototype, being built for demonstration purposes. The hull was fully planked, and the interior fitted ; also, on show were photographs showing the construction of the full-size vessel.

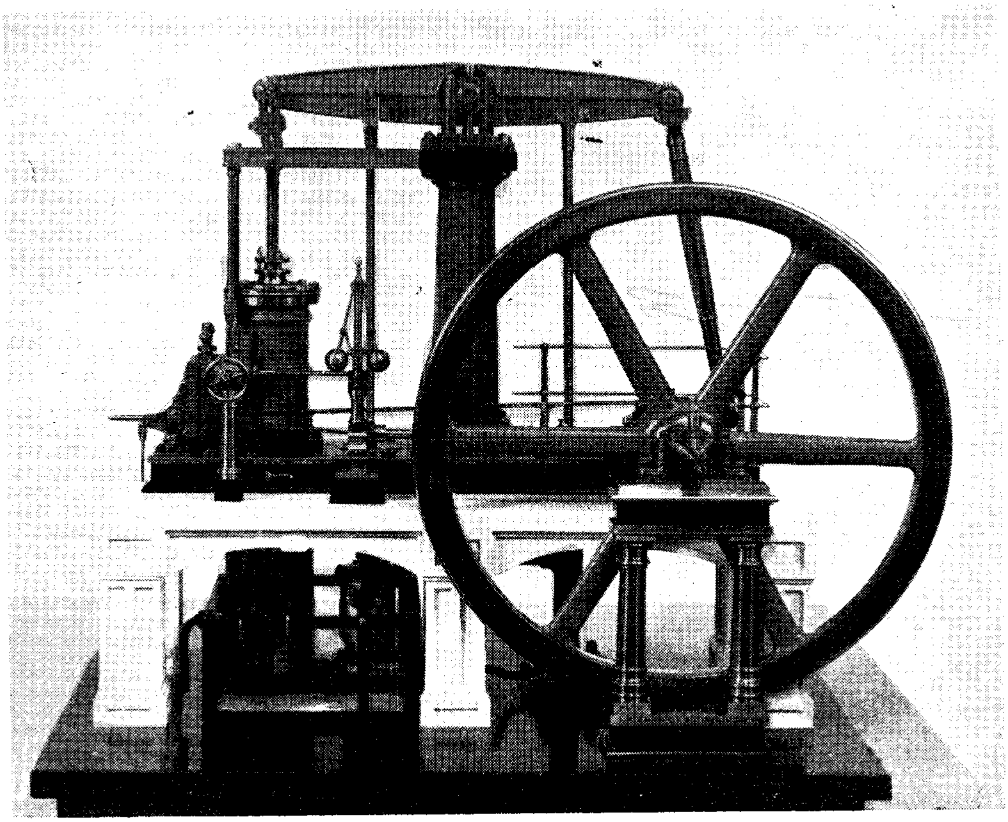
The car section appeared to indicate a steady rise in enthusiasm locally in this field, and the workmanship generally was of a very high order. First prize went to R. Ebbutt (Grantham). His car has a somewhat tubby appearance but its performance to date has apparently been satisfactory ; full speed tests have not yet been carried out. This was, incidentally, the only petrol-engined car on show. Second was Mr. E. J. Crossley (Leicester). A beaten aluminium body by F. L. Olley (Grantham) had very good lines, and we look forward to seeing the finished job at a future exhibition.

SOME MODEL STATIONARY ENGINES

by H. Booth

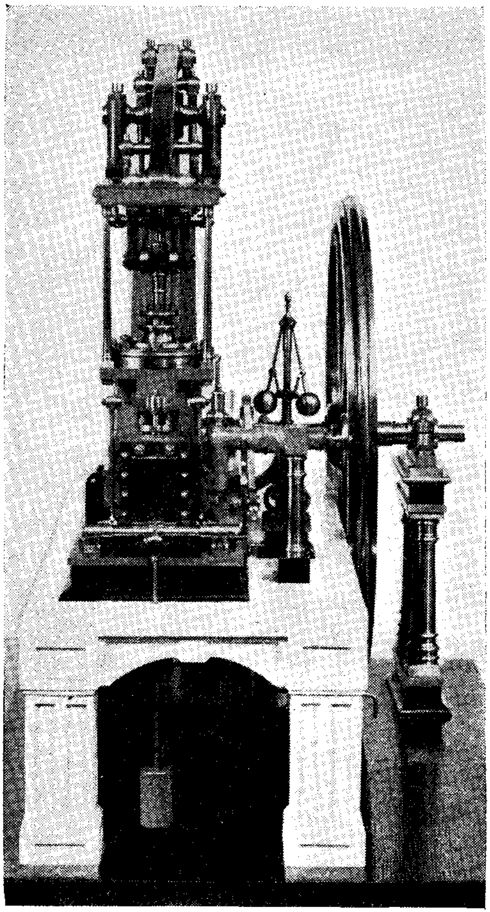
HEREWITH are some photographs of three models I have completed during the past few years, and I trust they may be of interest to readers.

The beam engine was actually broken up and some parts smelted down before I had finished taking all particulars and dimensions, but can truthfully say I got all that mattered. The dear old thing was in a shocking state and past recall when I first saw it; now it has gone altogether. In spite of all my efforts to find out the makers I still cannot definitely fix any name to it. The one thing I am almost sure of is her year of birth and birthplace; on the steamchest cover and "chipped" in with a "bull-nozed" chisel very deep was "LEEDS, 1847." That's all I can find out about her past. If I had been a rich man with a garden I would have fought tooth and nail for that lovely Grecian Doric centre column rather than let it go into the furnace.



Regarding the model, the cylinder is $1\frac{3}{4}$ in. bore, $3\frac{1}{2}$ in. stroke. Flywheel $13\frac{1}{2}$ in. dia., 28 pairs of split brasses. Condensing. The ends of the tank are panels of "Perspex" to enable the curious to see what is inside. Crankshaft, $\frac{5}{8}$ in. dia. Beam, $11\frac{1}{2}$ in. long. Chiefly made of cast-iron but the two pumps, force and circulating (?) and also the air pump are of gunmetal. The masonry is composed of seven nicely cast columns, three down each side and one under the column of engine. The governors are Watt type. Eccentric-rod is of the open type and the engine runs the correct way for this type (inwards).

Patterns were made by myself. The castings were made for me by Mr. Harvey, of Sheffield. To him, my very best thanks. Quite a lot of the



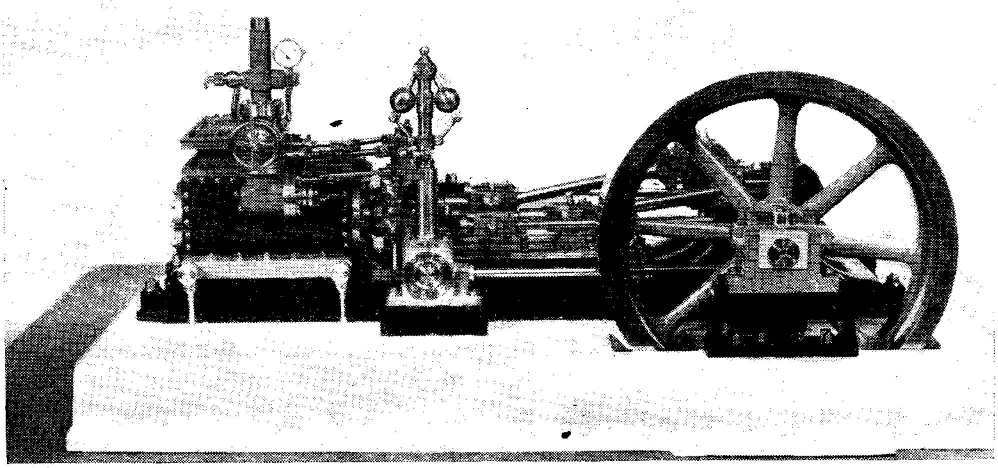
parts were carved from the solid. I just loved making it.

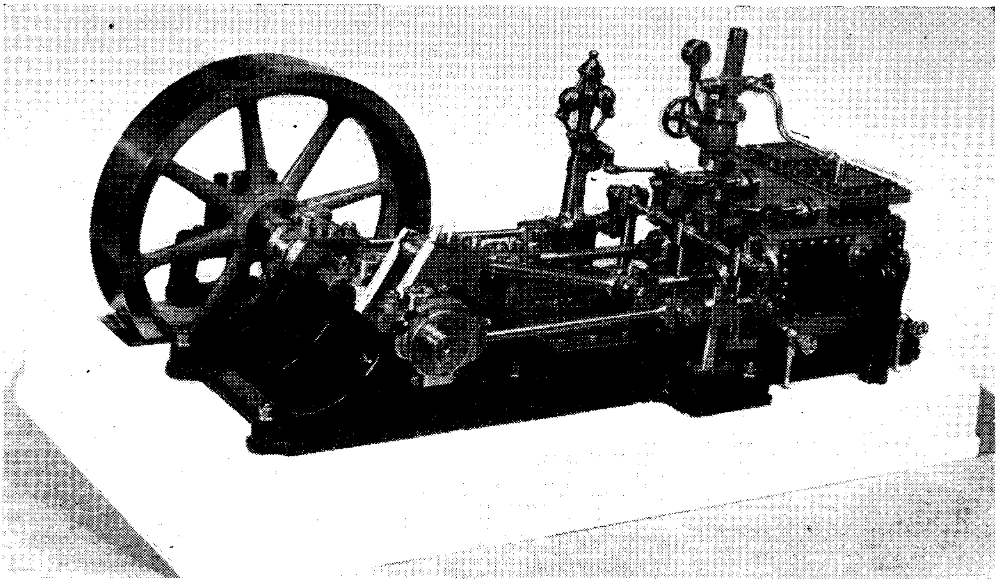
The first time I saw the original, she stood in a broken-down building. The roof had long since gone and the floor was buried under about 2 ft. of water and rubbish. She stood with the flywheel quite close to the wall ; in fact, it was let into the wall and in that wall were notches cut out to enable the engineman to get a prise on the flywheel spoke when she stopped on dead centre, using a bar of some sort. The outer bearing and the column were built into an alcove in the wall, and the end of the shaft came into another and larger room. The original drive had been dispensed with and only a steel-spoked pulley, about 5 ft. dia., 6 in. face, remained. This pulley dropped to pieces when I touched it, only two set-screws with square heads held it on ; no keyway or dimples, not even a flat filed on the shaft.

She Had Gone

Round the building, or engine house, ran a kind of verandah about the height of the column top, and the remains of a wooden banister lay across the beam. The steps leading up to this were just stones built into the wall without any support of any kind on the outside end, and they were very well worn. I crossed a couple of fields to get to the spot and often I went and took more dimensions and several snaps of which not one was a good one, owing to the very poor light, I think, or perhaps the operator was at fault. However, I was going on the same errand again but when I got there I was surprised to find out she had gone, so off I went after her. Yes, she had been carried off. When I found her she was a complete wreck and literally on the

Left—End view of the model beam engine





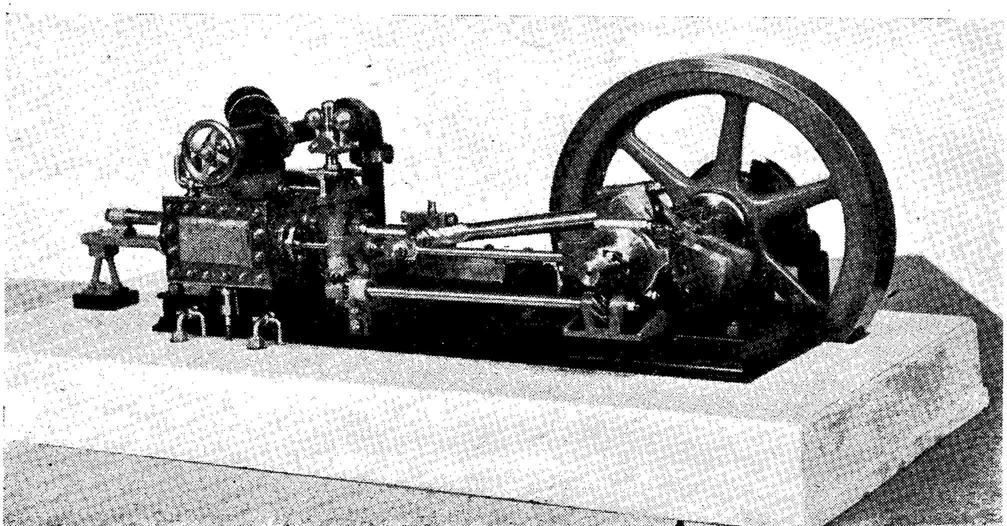
scrap heap. However, I got all I wanted in the way of particulars, but I would have liked that Grecian Doric column!

The Bolton-Bradford Horizontal

The compound horizontal is $1\frac{1}{4}$ in. and $1\frac{3}{4}$ in. $\times$ 3 stroke. The original of this is also broken up now. In fact, hardly a week passes by that I hear of another old stalwart being taken out and smashed; they are vanishing fast. The prototype was built in Bolton, in 1860, but was rebuilt later by a Bradford firm of repute. They were responsible for the connecting-rods and crank, which are of steel and replaced wrought iron ones; also, the flywheel was fitted at the same time. The original was of large diameter and in two halves and lighter than the later one, which was solid and 24 in. wide on the face.

Primitive Lagging

The steamchests and cylinders, together with rocking shafts and gear, were retained, but were



lagged when the rebuild occurred. The lagging originally was a mixture of cow dung and sand plastered on and held by wrought-iron bands. The valve rocker arms are quite interesting; they have a centre screw with a square on that was turned by a key to alter the stroke of the valves. A great number of set-screws were used on this engine, not studs and nuts. The governors are far more modern than the cylinder work and were made in Elland. She was a grand worker, and like a good many others, went to help win the war. Crankshaft of model, $\frac{3}{4}$ in. dia.; dia. of flywheel, $8\frac{1}{2}$ in. × 2 in. face.

Hard working Free-lance

The smaller single horizontal is $1\frac{7}{8}$ in. bore, 2 in. stroke, and was built from memory chiefly to no particular prototype but all the time I was working on this engine I had in mind a certain engine I had seen a long while ago driving a gas exhauster. It was made by a well-known firm and was a grand worker. In fact, so is this little one; she has done a rare lot of work for one so small. Recently, she had a run of a fortnight—seven hours a day non-stop!

Flywheel, 7 in. dia., $1\frac{1}{4}$ in. face; crankshaft, $\frac{5}{8}$ in. dia. Modified Hartnell governors working on the throttle and very sensitive, too. Most of this was cut from solid; only the cylinder, wheel and bed being castings. The tail-rod bracket, too, is a casting in iron.

These three engines were on show in the Cartwright Memorial Hall Museum, Bradford, in 1949.

Coal-Firing a Small Traction Engine

by H. H. Cooper

IN the "M.E." of November 30th, 1950, Commander Mitford concludes the description of his small traction engine by saying that he sees no reason why this engine should not have a coal-fired boiler. Less than a week before the above article appeared I succeeded in getting a small traction, 14 in. long, to burn coal. In the issue for November 11th, 1943, a short article by me on traction engines appeared. This was followed by one by Mr. Bradley who was kind enough not only to agree with points I raised but to emphasise them, and more recently by Messrs. Clarke, Bettles and Hughes.

I Had a Go!

Having told others a little of what to aim at, I felt it was up to me to have a go myself. As my equipment, spare time, skill and cash were all very limited, something simple and not too large seemed essential. A single-cylinder Burrell was decided on. Rough drawings were made from memory to about 1 in. to 1 ft. Then the spare time fell to nil and it was not until nearly the end of the war that I was able to make a start. By this time materials and tools were almost unobtainable and all I could get was a piece of 2 in. copper tube just large enough for the boiler barrel. This was only four-fifths of the diameter I wanted, so the whole model had to be made to four-fifths of 1 in. I had by me a piece of copper tube nearly twice as thick as "L.B.S.C." specifies for $2\frac{1}{2}$-in. gauge fireboxes. But firebox and backplate and front tubeplate were made from this. I managed to find enough 9/32-in. outside dia. brass tube to fit four tubes. Smokebox and cylinder saddle were made from old 2 in. bore brass pump lining. Cylinder block was carved out of a piece of hexagonal brass. Top and valve-chests made out of a scrap duralumin bracket.

My tools were a 4-in. Drummond lathe, treadle-driven, a small hand grinder and 1-pint blowlamp, and few hand tools and vice. The only screwing tackle I had was a die for cycle spokes. So I made a tap to suit, out of a rat-tail file. Studs for covers of cylinders were pieces of cycle spoke, with nuts made out of scrap pieces of Sifbronze rod. These were drilled and tapped and filed hexagon in the lathe, using chuck jaws as a guide, then parted off. The six-spoke flywheel was made from $3\frac{1}{2}$ in. × $\frac{5}{8}$ in. flat iron, as used for making cart tyres. I picked cold evenings to turn this up (and I wasn't cold!). Chimney base is part of $\frac{1}{2}$-in. brass water tap. Chimney is $\frac{3}{4}$-in. galvanised water pipe turned down and a vee cut in, closed up and brazed. Expansion link and die are made from mowing machine knife back. By this time, spare time again fell to zero due to moving. When I was able to start again I had got electric light (previously, I only had a paraffin lamp standing on the bench) and at the 1949 exhibition I bought a $\frac{1}{4}$-h.p. motor for the lathe. Valve-gear, etc., was now made up following "L.B.S.C.'s" principles, including a model of cardboard and pins. As soon as this was done air was put into the boiler by a cycle pump and off she went. But when I tried to get going on coal I had no success. After trying for a long time, I gave it up and had given up the engine as a bad job.

Success with Coal-firing

Then I read Mr. Froud's description of his lively little engine and fitted mine with spirit firing. I next made the rear wheels all from scrap. Then an "L.B.S.C." article on a totally different matter set me thinking. I made a slight alteration, tried coal-firing again and with success. But firing is very tricky and needs constant attention. I have only run the engine as a stationary, as she is far from finished. If I ever get her finished, I will try to get some photographs of her.

In conclusion, I would like to say that I agree entirely with what Mr. Hughes had to say about the traction engines at the exhibition.

IN THE WORKSHOP

by "Duplex"

No. 103.—*Making a Twist Drill Grinding Jig

THE base bracket can now be attached to the baseplate, and for this purpose it is, perhaps, best to fit temporary screws, as these may often have to be removed during the course of construction and the heads may suffer damage. This is the usual practice in some trades producing highly-finished, hand-made articles.

The centre-drilled hole, denoting the position of the table pivot (*H*), was then set to run truly with the aid of a centre-finder. The bore was next drilled and then bored to a good finish, but, to ensure an accurate and lasting working fit for the spindle, it is advisable to finish the bore by lapping.

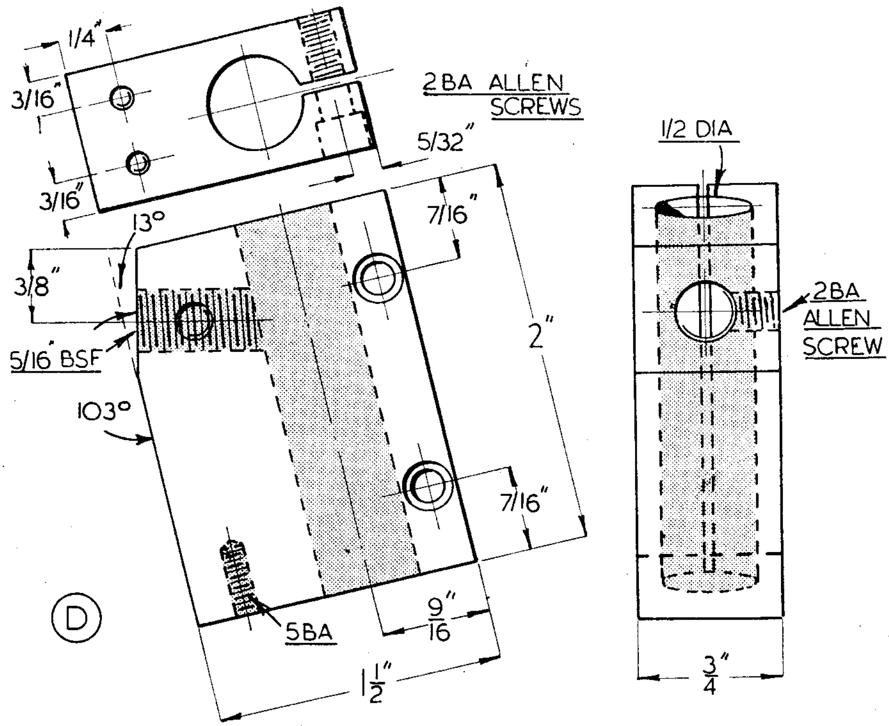


Fig. 19. *The pivot bracket*

At this stage, it may make for convenient working if the baseplate, together with its bracket, is mounted on a rough, temporary base of the kind illustrated in Fig. 1 of a previous article.

The Pivot Bracket—D

This part was made from a short length of mild-steel bar. After being squared up and marked-out, the work was gripped in the four-jaw chuck with the upper end facing outwards.

At the same setting, the upper surface of the bracket is faced true to form a seating for the thrust-collar (*J*).

The flat, against which the spindle (*E*) screws, can be machined with a milling cutter or a fly-cutter after setting up the work in a machine vice attached to the vertical slide. To give the correct cone angle of 26 deg. for grinding the drill, as explained in a previous article, this flat is formed at an angle of 13 deg., corresponding to an angle of 103 deg. when taken from the upper, datum surface.

Before removing the work from the vice, the pivot centre is marked-out with the jenny

Continued from page 653, "M.E.," November 15, 1951.

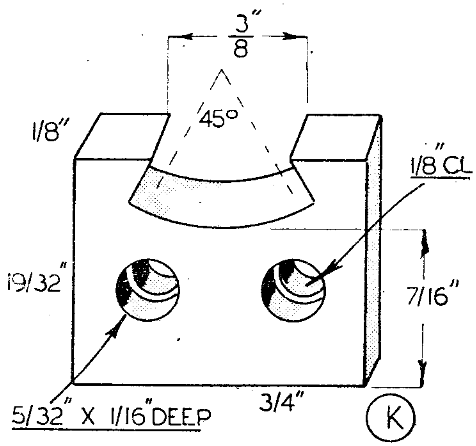


Fig. 20. The table pivot stop-plate

calipers, and then drilled and tapped with the tools gripped in the lathe chuck. After being screwed home, the spindle (*E*) is secured with an Allen set-screw.

To allow for taking up wear and to provide some frictional control, the bracket is furnished with two Allen adjusting-screws for contracting the bore after the part has been slit along its long axis. After these screws have been fitted, the bracket is put aside to be slit through to the bore, in the manner illustrated in Fig. 18, after the pivot has been accurately fitted; for slitting the material may cause the bore to lose its circularity owing to the opening or closing of the metal, and this would make the work of fitting the spindle much more difficult.

The Table Pivot—H

This part is best turned between centres and finally lapped to a close working-fit in the bore in the bracket (*D*). The threaded portion should for the present, be left fully long, as it is filed off later when assembled in the table.

To give a better bearing, the spindle is waisted after lapping; that is to say, the diameter of the middle third of the bearing surface is reduced by 5 thousandths of an inch or more to give clearance.

The Thrust Collars—I and J

These collars are made a close sliding-fit on the spindle, and as the ½ in. dia. lap has already been in use, it can again be employed as a quick and accurate means of finishing the collar bores to size.

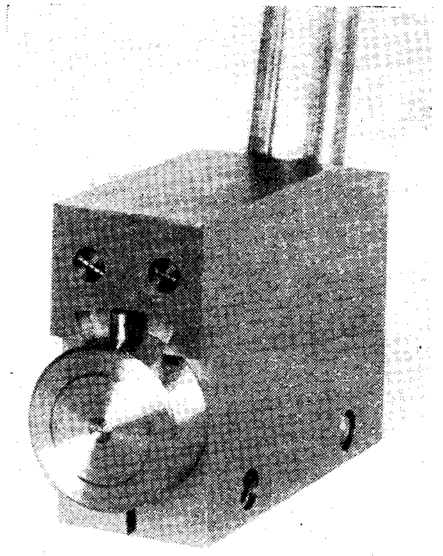


Fig. 22. Showing the position of the stop-plate and collar

At the lower end of the spindle, the thrust collar (*I*) forms part of the stop mechanism for limiting the rotation of the spindle in the pivot bracket (*D*). As shown in the photograph, Fig. 22, a stop-plate (*K*) is secured to the under side of the bracket and is cut away to allow the pivot to rotate through an angle of 45 deg. under the control of the stop-pin fitted to the adjustable collar (*I*).

The Table—G

A short length of mild-steel bar, 1¾ in. in

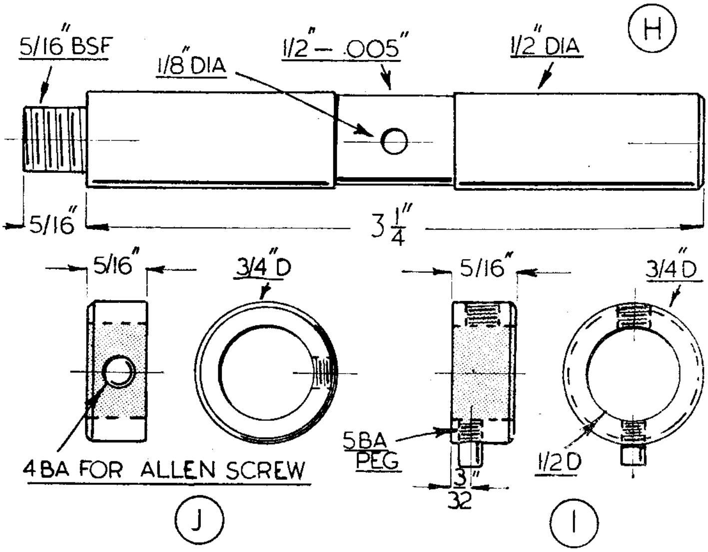


Fig 21. The table pivot and thrust collars

width and $\frac{1}{2}$ in. in thickness, was used for making this part.

The material is first squared up, as the edges will be required as datum surfaces for marking-out and machining. Although the finished table is shown mounted on its spindle in Fig. 23, the rectangular form of the component, as illustrated in Fig. 25, should be preserved until the construction of the jig is nearly completed.

As the upper surface of the table, carrying the drill slide (*L*), forms an angle of 59 deg. with the face of the grinding wheel, and the pivot (*H*) is set at an angle of 13 deg. to the wheel, the table is mounted on its spindle at an angle of 46 deg.

The method used for machining this angular seating in the table is illustrated in Fig. 25. The work was gripped in a small machine vice secured to the lathe cross-slide, and after the scribed centre had been set at centre height, the face of the work was aligned by means of a protractor held against the chuck face. To complete the set-up, the cross-slide was adjusted to bring the scribed centre into contact with the tip of a pointed rod gripped in the chuck.

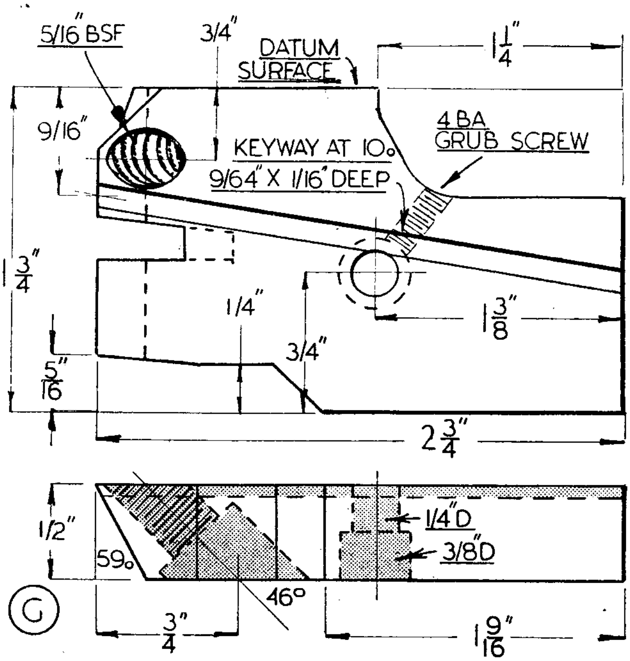


Fig. 24. *The table*

The cross-slide index was then set to zero. After the flat seating had been milled to the required depth with a two-lipped slotting cutter, the cross-slide was returned to the zero position and then securely locked. To complete the machining of the pivot seating, a centre drill, a pilot drill, a tapping-size drill, and then a tap were in turn mounted in the chuck.

When marking-out the keyway, the right-hand edge of the table as viewed from above is used as the datum surface.

Van Royen stated that this keyway should be formed at an angle of 3 deg. 10 min. to the axial line, but this figure was not found to be correct when the jig was tested. The required angle was, therefore, worked out experimentally and was found to be 10 deg.

After the keyway has been cut, the forward end of the table can be chamfered to an angle of 59 deg., but no further work on the part should be attempted at this stage.

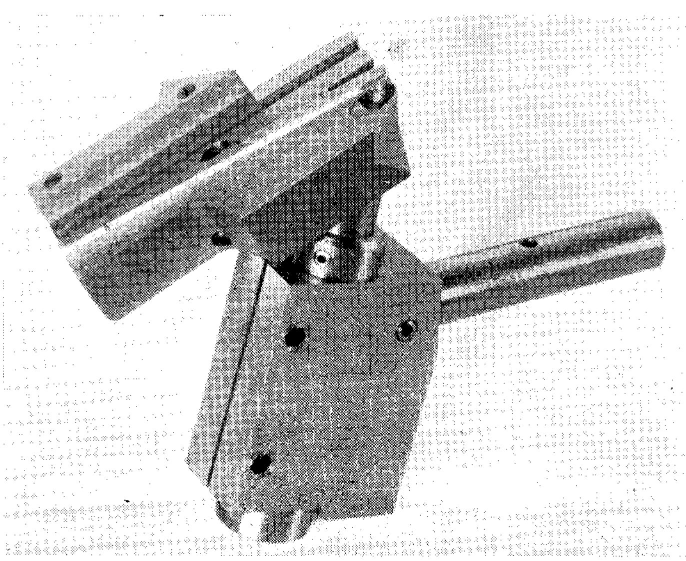


Fig. 23. *The table, spindle and bracket assembly*

The Drill Slide—L

Although a casting might be used for this part, the work would then be difficult to hold when machining all faces square and parallel ; moreover, strength might be lacking and warping might also occur during machining. Instead, a length of mild-steel strip, $1\frac{1}{2}$ in. in width and $\frac{1}{4}$ in. thick, was selected.

The full length of the drill slide illustrated is 7 in. so as to accommodate a standard, jobber's length twist drill of $\frac{1}{2}$ in. dia., but if in the larger sizes Dormer stub drills are to be

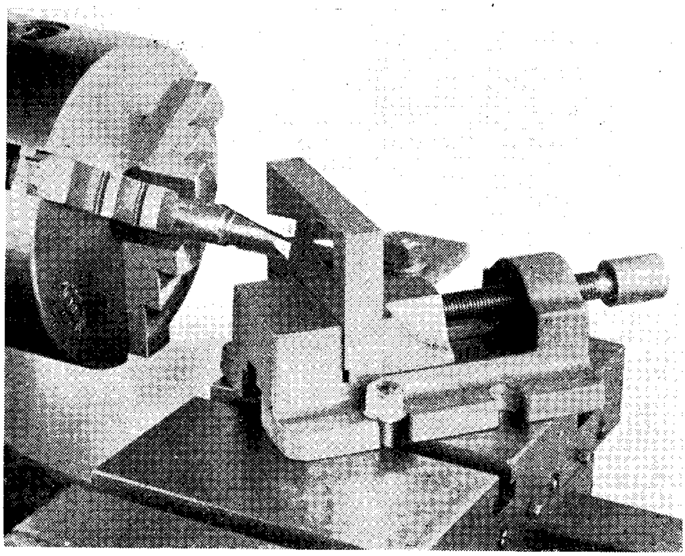


Fig. 25. Machining the pivot seating in the table

used, the length of the slide can then be reduced by 2 in.

This reduction in length will enable the long keyway to be cut in a small shaping machine, or, perhaps, even in the lathe.

After the surfaces of the component have been trued by shaping, milling, or filing, the long keyway for the drill rest and the tailstock is machined exactly parallel with the datum edge of the work.

The actual width of this keyway is not important, but the depth should be sufficient to afford guidance for the small tailstock (*Q*).

Again, the forward end of the slide is chamfered to an angle of 59 deg. to clear the grinding wheel, but the rectangular shape of the component should be retained until a later stage.

The Drill Rest—P

This part is made in conjunction with the tailstock, both to save time and to ensure that the same centre height is maintained. A piece of ¾-in. square mild-steel, 2¾ in. in length, is machined by shaping or milling, and the two parts are later separated with the hacksaw. The forward end of the drill rest is cut away to an angle of 59 deg. and at the same time the recess to accommodate the lip guide is machined.

The rest can now be attached to the slide by means of two screws inserted from below.

The next step is to mount the drill slide on the table in the zero position ; that is to say, with the centre-line of the V and also the point of a drill of zero diameter both coinciding with the axis of the table pivot (*H*). This can readily be done, as illustrated in Fig. 28, by gripping the table pivot in the chuck and bringing up the back centre to indicate the axis of the pivot.

If the machining has been accurately carried out, the side faces of both the drill slide and the table should coincide when the V is set in line with the lathe tailstock centre. When determining the forward position of the drill slide,

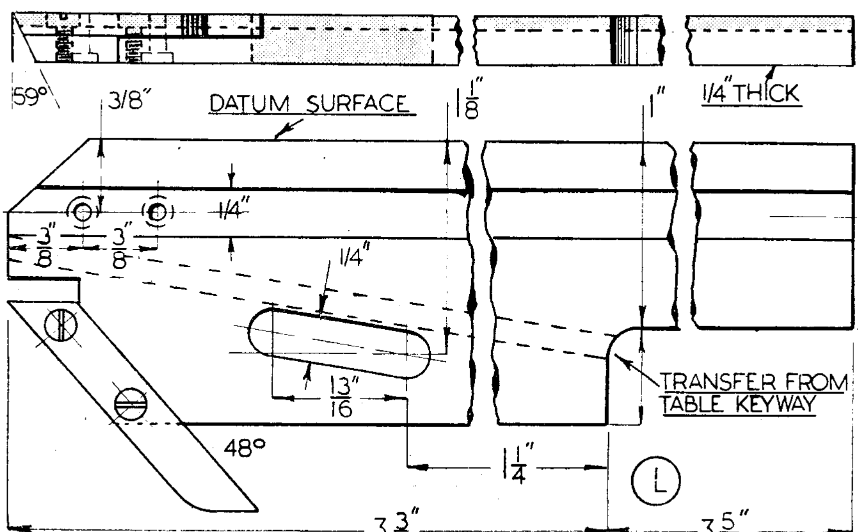


Fig. 26. The drill slide

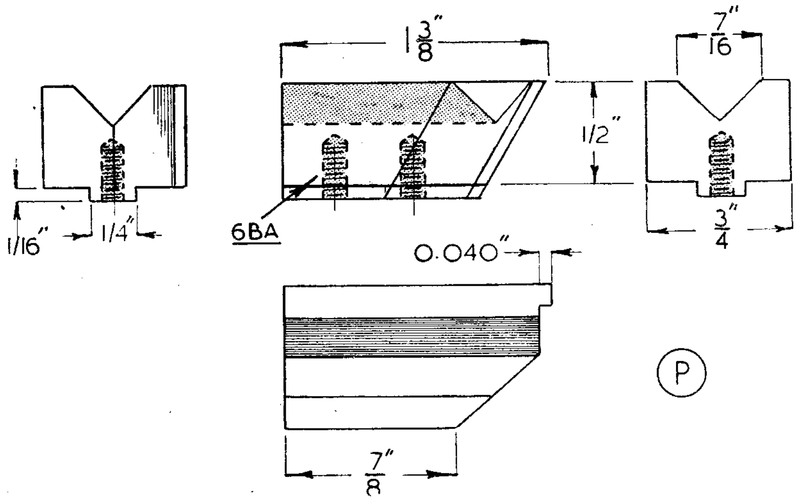


Fig. 27. The drill rest

the point of the tailstock centre must be separated from the front end of the floor of the V by an interval equal to the thickness of the lip gauge, 40 thousandths of an inch, plus the distance the drill point will project beyond the lip gauge, 10 thousandths of an inch; making 50 thousandths in all.

When this setting has been obtained, the two parts must be firmly clamped together with two or more toolmaker's clamps.

A hole is then drilled, and afterwards reamed, right through both parts in the position shown in the drawings. If a well-fitting bolt is then inserted, the drill slide will be located in the zero position when the side faces of the two parts are set to lie parallel with one another. With the two parts clamped together in this way in the zero position, the position of the keyway in the drill slide can be marked-out from the ends of the keyway showing in the table. The key itself is next fitted and it can quite well be made a close sliding fit in both components, for the key is end-located by means of the clamp-bolt passing through one side; this is shown in the drawing of the table, Fig. 24, but in Fig. 26, for the sake of clarity, the slot in the drill slide is represented as lying clear of the keyway.

The drill hole for the clamping-bolt can now be extended backwards to form the slot that enables the drill slide to be moved forwards. The edges of the slot are first marked-out parallel with the keyway, and the slot is then formed to shape by end-milling or drilling and filing.

The remaining part of the original bolt hole in the drill slide should not be altered in any way, as it provides a ready means of setting the jig in the zero position at any time during construction.

(*To be continued*)

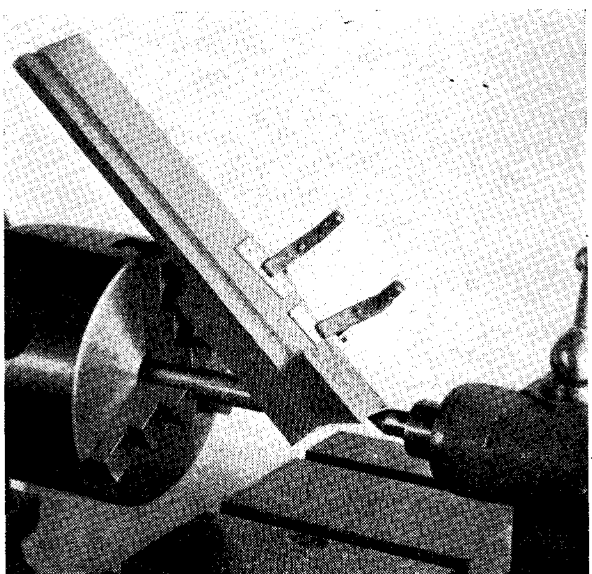


Fig. 28. Method of locating the drill slide on the table in the zero position

PRACTICAL LETTERS

"That Wonderful Year . . ."

DEAR SIR,—In the issue of October 18th, there is an illustration of a model locomotive by Watkin & Hill. I showed this to a friend who was formerly at Elliots of Lewisham (who took over Watkin & Hill many years ago). He said that there was formerly in the office a model of a locomotive by Watkin & Hill and that Mr. A. W. Marshall, in the course of a visit, drew his attention to the fact that the driving wheels had no flanges, also remarking: "Next time I come, I will tell you why." However, the second visit never occurred. It is quite possible that this model is still in the offices at Lewisham.

I would like to suggest, turning to another topic, that Mr. Bowyer Lome be invited to describe his small dividing heads, he exhibited at the "M.E." Exhibition. I know of several people with small milling machines who were very interested and three of us borrowed the patterns and had castings made.

Yours sincerely,

Keston. E. C. YALDEN.

DEAR SIR,—I am gratified to note that my series of articles published under the above title proved of interest to many readers, although, like yourself, I anticipated that some might condemn the idea. But I was highly amused to read, in your "Smoke Ring" of 25-10-51, the opinion of the gentleman who thinks that "digging up the past, can achieve nothing and lead us nowhere."

For isn't it that very same past that *has* led us to where we are today? And, putting aside the fact that man seems determined constantly to misuse the gifts which engineers and scientists place at his disposal, is not life today much more enjoyable and full than it was a century ago? If this has "achieved nothing," then what in the name of goodness does your correspondent consider achievement?

With regard to the charge of "wasting space" by publishing these articles, I think most readers will find in *every* issue of THE MODEL ENGINEER something which does not particularly appeal to them. For example, although I can and did enjoy the spectacle of miniature Grand Prix racing, I am not particularly interested in the articles describing how to do it. At the same time, I have read those articles, partly because I realise that the innovators of this sport have achieved something, partly because I admire ingenuity and good craftsmanship of any kind, and partly because I like to keep abreast of the times as well as to dig into the past!

Tolerance

It seems to me that this correspondent and others would do well to re-read your "Smoke Ring" of 18-10-51 quoting Mr. L. J. Oldridge's observations on "Tolerance." I have heard an ardent steam fan describe a racing-car as a "stinking buzz-box," and five minutes later the builder of the said racing-car described a steam locomotive as an "anachronism principally designed for polluting the atmosphere." Yet I, who have not the slightest desire or intention to build either, have derived a considerable pleasure from a close examination of *both* the offending articles!

So with the contents of THE MODEL ENGINEER, and indeed with life itself. It is the selfish people of the earth who cause the strife, not the tolerant ones who realise that the other fellow's point of view has something in it. Let us, as members of one of the friendliest brotherhoods on earth, set the others even more of an example than we do already! Especially since, by so doing, we shall find much greater enjoyment of our hobby.

Yours faithfully,

Yorkshire. "THE DOMINIE."

Steam Ploughing Tackle

DEAR SIR,—I was most interested in the letter by E. Devett Sage in THE MODEL ENGINEER for September 27th. As a boy, I made many trips to Messrs. Bromford & Evershed's yard at Salford Priors.

To renew old sights I have recently visited the same yard and looked over many of the engines there which, I am sorry to say, are in the main, in shocking condition. Quite a few of the Fowler compounds have been converted to diesel power, either by cutting away the tender and mounting the oil engine on the platform obtained, or removing the cylinder-block and chimney, riveting hornplates to smokebox and boiler barrel and mounting the oil engine on top.

However, many retain their steam "shape," and in the yard are seven Fowler compound and five Fowler single-cylinder engines. Four of the latter have Slater spring-balance safety-valves. I fancy the latter five have been rebuilt by Bromford & Evershed, possibly reboilered, as the Fowler name and number plates have been removed and the cover plate on the cylinder slide-valve is of B. and M. pattern with the number stamped on, which numbers are very low as compared with the numbers on the other Fowler engines there.

Also to be seen are eighteen Aveling & Porter single-cylinder road rollers, only one being in working condition.

I think Mr. Hughes would find a journey to this yard well worth the trouble, if only to see Fowler No. 16720 which is a 21-tonner, a real monster compared with the rest. I have quite a few particulars and measurements for this engine.

For your interest here are the engine numbers: Fowler compound, 15210, 13863, 14505, 14253, 16720 and two with number plates missing. Fowler or B. and E.? Single cylinder: 3229, 3396, 4223, 3230, 7272 River class. A. & P. road rollers: 2049, 5053, 3160, 3482, 2970, 1809, 2222, 2688, 4620, 4318, 3939, 3155, 3114, 2302, 3321, 2064, 3142.

Yours faithfully,

Birmingham. G. B. FEATHERSTONE.

Grinding Twist Drills

DEAR SIR,—" Duplex " seem to suggest, in their article on " Making a Twist Drill Grinding Jig," that Van Royen explains all the geometrical requirements.

I wonder if " Duplex " can say why a 1.4 point projection of the drill beyond the axis of swing, gives the required result. It is found to do so, with respect to the stipulated axis settings, but is that due to empirical results or geometrical prediction? Van Royen does not seem to explain that to me.

Further, if you accept the axis settings and point projection relationships Van Royen states have given good results, and then question what, geometrically, would be the effect of varying one factor in the relationships, you cannot trace the consequences from his treatment—or am I mistaken?

Drill grinding jigs on the market that give satisfactory results within their range appear to me from examination to vary these relationships over a great range and yet the result is an effective drill point. What are the really critical requirements, and by what geometrical reasoning do the varying designs get the result?

I do not write to belittle or detract from the merits of Van Royen's article, for it is the most comprehensive study of the subject I have found in engineering literature, whether text-book or journal, and congratulated THE MODEL ENGINEER on presenting so early (1914) information not to be found elsewhere even today. Incidentally, it is the first time I have seen the architectural term " arris " used in relation to drills—it fits the case absolutely.

Yours faithfully,

Bristol. W. D. ARNOT.

CLUB ANNOUNCEMENTS

International Radio Controlled Models Society

Forthcoming meetings of the above society are as follows:

Birmingham Group. Saturday, December 1st, at 2.30 p.m., at the Birmingham International Centre, 83, Suffolk Street.

London Group. Sunday, December 9th, at 2 p.m., at the Horseshoe Hotel, Tottenham Court Road.

Tyneside Group. Saturday, December 22nd, at 7.30 p.m., at 176, Westgate Road. Discussion on " Dual Control "; also on January 26th, on " Transmitter and Receiver Circuits."

Hon. Secretary: C. H. LINDSEY, 292, Bramhall Lane South, Bramhall, Stockport, Cheshire.

The Junior Institution of Engineers

Midland Section. Thursday, November 29th, at the New Inns Hotel, Handsworth. Annual dinner and dance.

Friday, November 30th, at 6.30 p.m., at 39, Victoria Street, S.W.1. Informal meeting. Illustrated talk on " Some American Windmills." by Rex Wailes, M.I.Mech.E. (Member.)

North Western Section. Monday, December 3rd, at 7.30 p.m. Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. Ordinary meeting. Paper, " Power Stations," by F. Marshall.

Friday, December 7th, at 6.30 p.m., at 39, Victoria Street, S.W.1. Film evening: " Arc Welding." (Quasi Arc Co. Ltd.)

Friday, December 14th, at 7.30 p.m. Royal Society of Arts, John Adam Street, Adelphi, W.C. Inaugural meeting and delivery of Presidential Address by Air Commodore F. R. Banks, O.B.E., C.B., entitled " Enterprise in Engineering."

Sheffield and District Local Section. Monday, December 17th at 7.30 p.m. at the Co-operative Educational Centre, 201, Napier Street, Sheffield, 11. Ordinary meeting. Paper, " Aluminium Alloys in General Engineering," by M. H. Levie, B.Sc.(Tech.)Hons, A.M.I.Mech.E., A.M.I.Loco.E. (Member.)

Friday, December 28th, at 39, Victoria Street, S.W.1. Ordinary meeting. Paper, " Recent Developments in Hydro-electric Power," by J. Foster Petree, M.I.Mech.E., A.M.I.N.A. (Member.)

Friday, January 4th, at 6.30 p.m., at 39, Victoria Street Westminster, S.W.1. Film evening: " Rocket Flight, to be introduced by S. G. Clark.

Sutton Coldfield and North Birmingham Model Engineering Society

Owing to pressure of business both our secretary and our treasurer have had to resign. They have been succeeded by the following: Hon. Treasurer: F. E. Hawthorn; Hon. Secretary: J. W. REVILL, 75, Churchill Road, Birmingham, 9.

The Tees-side Society of Model and Experimental Engineers

On Tuesday, November 13th, 1951, members expected to hear a talk on " The Cinema," but the lecturer was unable to attend as arranged, owing to illness. The chairman, Dr. W. H. Maclennan stepped into the breach, however, and gave members a further instalment of a kind of technical serial, the earlier portions of which have been given from time to time. This technical serial deals with the theoretical and practical aspects of steam raising, control and utilisation as applied to model steam locomotives; it provoked a lively discussion and in this and the earlier talks, members appreciated that they had been fortunate in having " sat at the feet of Gamaliel " in such matters.

Hon. Secretary: J. H. CARTER, 28, East Avenue, Billingham, Co. Durham.

Ickenham and District Society of Model Engineers

The above society welcomed Mr. K. A. C. R. Nunn as an old friend recently when he gave a most interesting talk on developments on the railways since 1825, ably illustrated by lantern slides most of which are from his own photographs. His knowledge of railway matters is immense and his memory for locomotive types and performance is uncanny. Mr. Nunn has the happy way of carrying his audience away with his own enthusiasm.

It is hoped that we shall soon see the completion of one or two 5-in. gauge locomotives which have been impatiently awaited.

Visitors are always welcome at the Memorial Hall (opposite the " Fox and Geese," Ickenham) on Friday evenings. Details may be obtained from the Hon. Secretary, F. HOUCHIN, 17, Evelyns Close, South Hillingdon, Middx.

Eastbourne Society of Model Engineers

The winter programme of the above society is as follows:—

December 12th. " Any Questions."

1952.

January 9th. Steam night.

January 23rd. Film night.

February 6th. Talk by Mr. L. Burville—" Sound Projectors."

February 20th. Film night.

March 5th. " Lecturettes."

March 19th. Film night.

April 2nd. Track night.

Film Nights. These may be altered to other subjects at short notice.

Hon. Secretary: C. T. UPTON, 13, Lawns Avenue, Eastbourne.

Ashton-under-Lyne Model Engineering Society

Since publication of our last report we have erected a hut large enough to hold meetings in on the ground we are renting from the Ashton-under-Lyne Corporation in King George Playing Fields.

Good progress has also been made on the embankment for the track we are erecting and despite the unevenness of the ground at least 300 out of the 400 ft. has been levelled off ready for the track. At one point the embankment is over 6 ft. higher than ground level. Every effort is being made to complete the track by the coming spring, when we hope to hold a grand opening. Several locomotives are under construction, including *Hielan Lassie*, *Pamela*, two *Juliets*, several *Tich's*, and at least four of the locomotives should be ready for the opening.

Hon. Secretary: R. DIGGLES, 25, Lime Grove, Ashton-under-Lyne.