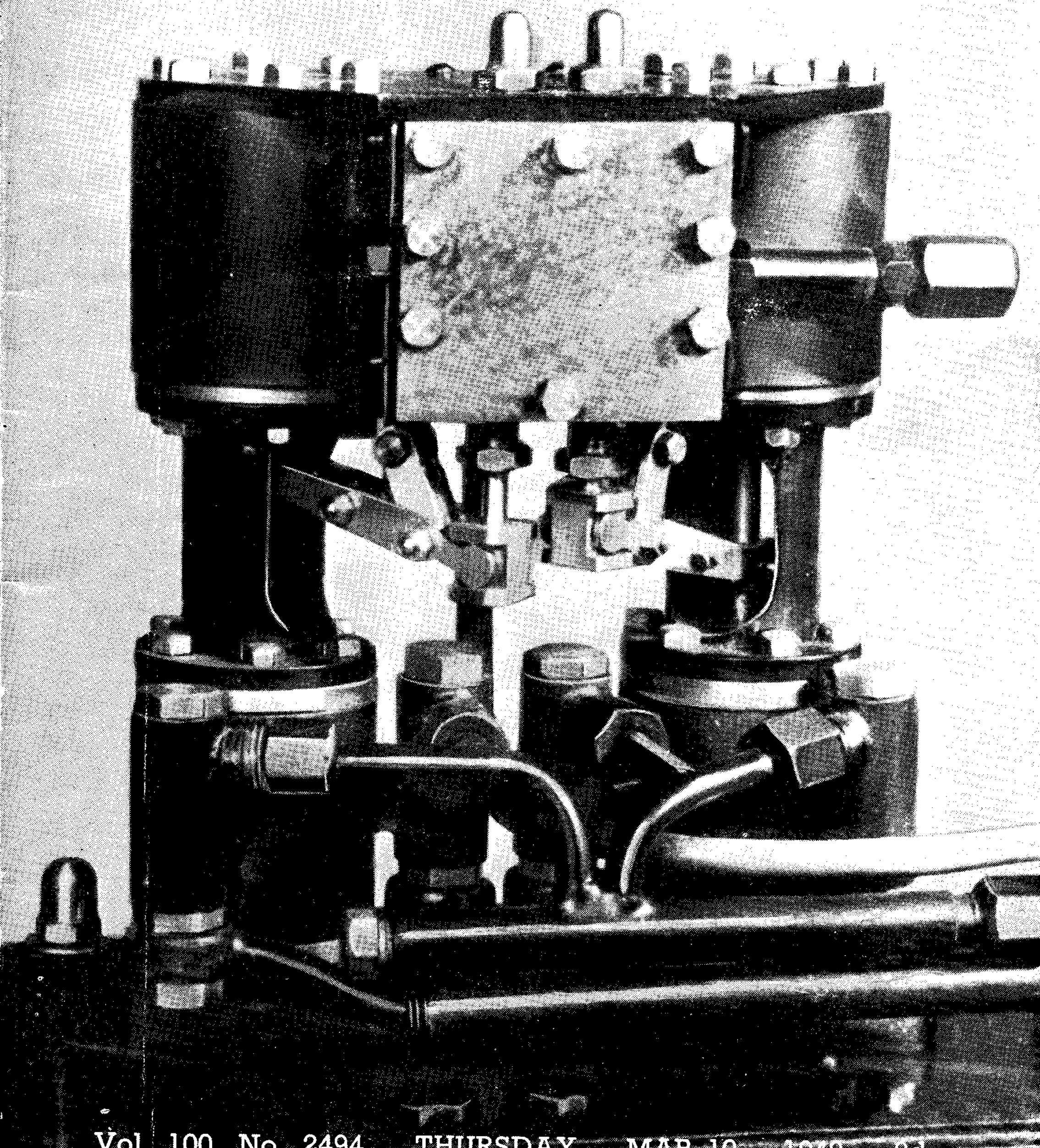
THE MODEL ENGINEER



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The MODEL ENGINEER

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

10TH MARCH 1949 VOL. 100 NO. 2494

SMOKE RINGS

Our Cover Picture

● THIS WEEK, we have chosen a close-up picture of a neat little duplex pump made by Mr. J. I. Austen-Walton. This pump design is not exactly new, but is an adaptation of the original duplex pump idea.

No castings were used, and the internal steam-ways are in the form of small pipes, cross-ported, and silver-soldered in place, quite invisibly, beneath the lagging. This system has the advantage of avoiding the valve-rods and levers having to pass each other.

The steam cylinders are $\frac{3}{8}$ in. bore, double-acting, and the water pumps are $\frac{3}{8}$ in. bore, also double-acting. The first pump was made with similar-sized steam cylinders ($\frac{5}{8}$ in.) but $\frac{1}{2}$ in. bore water pumps, and with this very small working advantage to cover frictional losses, it pumped against boiler pressure quite well. Later, it was discarded in favour of the smaller bore pump, but only because the rate of water feed fell off considerably at the higher boiler pressures.

It is fitted with slide-valves which have no difficulty in clearing the condensate that would choke any other type of valve, when starting from cold, and if working on wet steam, no lubrication is needed for cylinders and valves.

The total running time so far recorded under actual working conditions, is round about 400 hours.

Urgent Appeal

● SOMETHING LIKE an "S.O.S." has reached us from the Technical Institute, Dursley. Mr. A. W. Jones writes :—"For the past two-and-a half years we have been holding a model engineering class at the Dursley Technical Institute, working on a model of the 'King George V,' locomotive in $7\frac{1}{4}$-in. gauge. Recently, however, we have suffered a loss by several of our members leaving the district, cutting our total attendance down to five. The Institute rules state that no class can be continued if the attendance falls below eight. So you can see we are 'in a spot.'

"Can you help us by inserting a suitable note in THE MODEL ENGINEER to the effect that all 'lone hands' and keen model engineers in the Dursley district are invited to contact (by letter) either Mr. P. Woodland of the Technical Institute, or Mr. F. Jones, Mill Farm, Dursley."

This matter is certainly urgent, and we hope three, or more readers in the Dursley district will be able to go to the rescue of a deserving cause.

English Locomotives in Tasmania

MR. A. J. OCCLESHAW, writing from Melbourne, Australia, sends two interesting photographs reproduced on this page. They illustrate a 4-4-0 locomotive built by Beyer Peacock & Co. in 1886 for the Tasmanian Government Railways, and also, the maker's date-plate as still fixed to the driving splashers of these engines. Fifteen of these engines were supplied to the T.G.R., two in 1885, four in 1886, six in 1887 and three in 1890; at the moment of writing, seven are still in regular service. They are officially designated "Class B" and have cylinders $14\frac{1}{2}$ in. diameter and 20 in. stroke; coupled wheels 4 ft. diameter; bogie wheels 2 ft. diameter; boiler 3 ft. 10 in. diameter by 9 ft. $1\frac{1}{2}$ in. long; working pressure, 140 lb. and a tractive force of 9,811 lb. The height to the top of the chimney is 11 ft. 6 in. and the gauge is 3 ft. 6 in.

From the photograph, taken in September, 1948, there seems to have been little, if any alteration made to the original design, and this speaks well for engines now over sixty years old. Incidentally, it is interesting to notice the marked "family likeness" to the Adams 4-4-0 engines designed and built for the old London and South Western Railway, between 1880 and 1887; many of these were built by Beyer Peacock & Co.

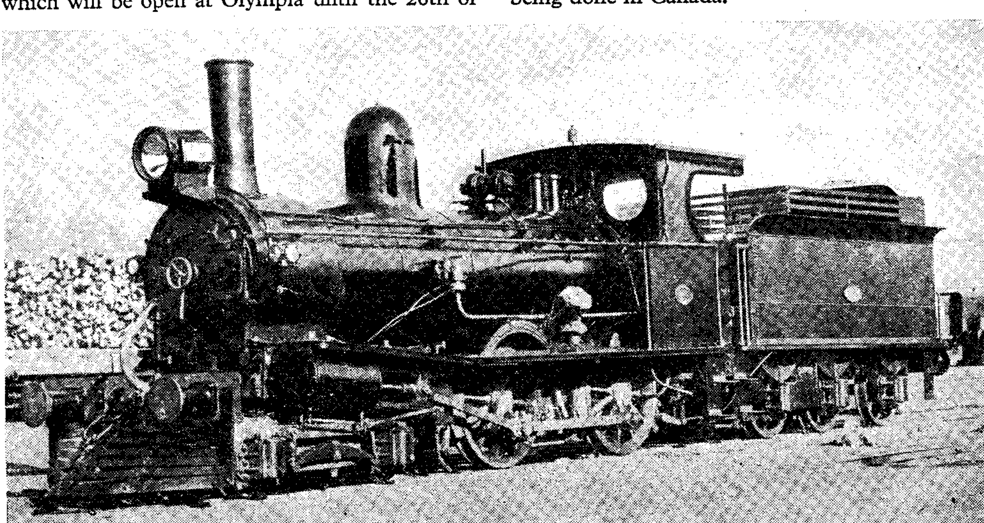
A Model Steel Works

● AT THE *Daily Mail* Ideal Home Exhibition which will be open at Olympia until the 26th of this month, the British Iron and Steel Federation are displaying a model measuring 60 ft. × 24 ft., of a complete steel works. There are 1,600 ft. of "OO" gauge track operating on the two-rail system. Included in this layout are a number of overhead travelling transporters and conveyors, also extremely realistic hoists and working model rolling mills. There is no doubt this beautifully executed model will be a centre of attraction.

News from Vancouver

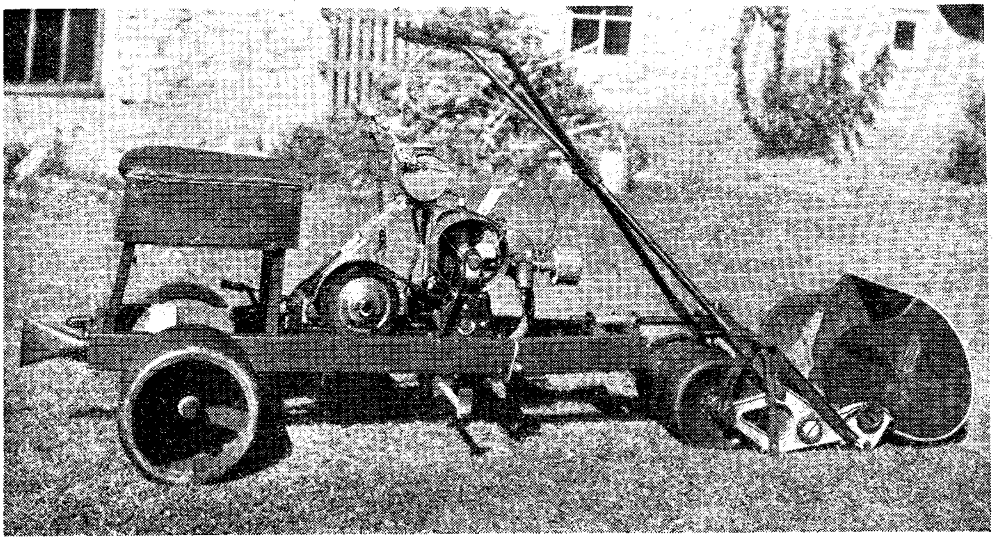
● A CHEERY and friendly letter has reached us from Wellwood R. Johnson, secretary of the Vancouver Society of Model and Experimental Engineers. Since we last heard from him, the society has been very active, and we are glad to learn that the membership is growing monthly. During the twelve days of the Hobby Show at the Pacific National Exhibition, the society operated a regular schedule of $\frac{1}{2}$-in., $\frac{3}{4}$-in. and 1-in. scale locomotives which hauled thousands of "youngsters and oldsters" on a 150-ft. straight track erected by the exhibition authorities, outside the Hobby building. Large compressors kept other working models running on air for about ten hours a day, and a policeman was needed to keep fascinated visitors on the move.

Mr. D. T. Hardy, one of the society's oldest members, recently completed a tour of the eastern and south central States of America, and was disappointed at what he saw of model making there; he is of the opinion that much more is being done in Canada.



Lawn Mowing de Luxe

by A. S. Keep



MOWING the lawn is a recurring penance which falls on model engineers who would much rather be in their workshops. Some are fortunate possessors of motor lawn-mowers which reduce the time and labour expended.

The writer is unfortunate enough to have two artificial legs, and cannot do the walking entailed with a hand- or motor-mower; but as the grass still had to be cut, it was necessary to devise a machine which would carry the operator and drive the mower.

This is the third season the motor pusher has been in operation, and no trouble has been experienced. Instead of being a burden, mowing the lawn is now regarded as a pleasant way of spending an hour with a pipe on a warm summer afternoon.

The mowing part of the outfit consists of a standard 12-in. J.P. hand lawn-mower. This type was chosen, as it is a good robust engineering job strong enough to stand up to the additional strain of power drive.

The only alteration was to fit an angle-iron framework for the attachment of the motor pusher. The centre of the crossbar above the A-frames carries a universal joint to which the bar of the pusher is attached by means of a ⅜-in. steel pin. This can be withdrawn by hand, and the mower detached in a matter of seconds and used by hand in the normal manner.

The mower can be replaced by a roller.

The motor pusher is built largely from odds and ends culled from various scrap heaps and represents many hours interesting work in the writer's workshop.

The chassis is made from 2-in. 16-gauge channel steel obtained from *ex*-A.R.P. stretcher runners, while the rear rollers (10 in. diam.) were picked up in a local agricultural engineer's scrap yard from an old horse-drawn mowing machine. These were fixed to a 1 in. diam. steel shaft running in plain phosphor-bronze bearings bolted underneath the chassis, the bolts working in slots to allow for tensioning the driving chain.

The engine is a very old type 1½-h.p. Villiers two-stroke, which had retired after long and arduous service in a mowing machine belonging to the local cricket club. It was rebored by the makers and is now as good as new, and has ample power for the job. Cooling is by a fan, belt-driven from a pulley on the crankshaft.

It was decided that it would be necessary to fit a reverse gear, otherwise difficulties would be continually arising owing to getting into places where there was insufficient width to turn round, so this meant making a gearbox with one speed forward, neutral, and reverse. Incidentally, this was the only part of the machine for which drawings were made, the rest was worked out from freehand sketches on odd bits of paper.

Fortunately, the scrapbox produced an old Raleigh motor-cycle gearbox and clutch. This was completely dismantled and the gear wheels removed. A new casing was made, together with fresh shafts and a reverse gear devised on the lines of a lathe tumbler gear. All the shafts run on ball-bearings. The gear change-lever can be seen in the photograph standing up behind the petrol tank. The gear ratios are equal for forward and reverse.

Climbing 1 *in* 7

The engine, gearbox, cooling fan, and petrol tank are built on a sub-frame which bolts on to two cross-members in the chassis and can be easily removed.

The drive from the engine to gearbox is by chain through the clutch, while a second chain transmits power from the driven shaft of the gearbox to the back axle.

The engine to back axle ratio is 22 to 1, which gives 3 m.p.h. at an engine speed of 2,000 r.p.m. At the usual mowing speed of about 2 m.p.h. this gives a very comfortable working speed for the engine. The starting handle fits into a dog which can be seen on the clutch shaft, and when not in use is carried in the tool box under the seat.

The air strainer in front of the carburettor is a very necessary fitment to keep flying grass out of the engine, and started life as a 4-oz. tobacco tin.

Among this collection of odds and ends it is pleasant to be able to point to a little blue blood. The forgings carrying the clutch pedal and the brake shoe lever are Rolls Royce aero engine control-levers which lend tone to the machine!

On the opposite side to the clutch pedal is the hand brake which operates a shoe on the rear roller.

The performance is remarkably good. The writer's lawn has an average slope of 1 in 10, and parts are considerably steeper, as for example by the tool shed, where the photograph was taken, the slope is about 1 in 7 which the machine tackles with ease. To show there is no deception, the slight haze of the exhaust can be seen issuing from the fishtail! In fact, anything the driving rollers will grip on can be driven over. Owing to the weight and low centre of gravity combined with a track of 3 ft. there is no tendency to turn over.

For the Bookshelf

Railway Wagon and Tank Construction and Repair, by F. Ogden. (London: Sir Isaac Pitman & Sons, Ltd.) Price 18s. net.

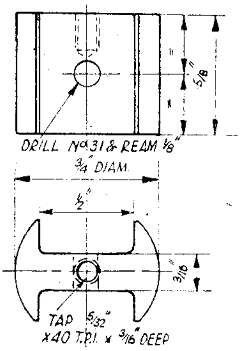
This book is a thoroughly practical and informative instruction manual intended primarily for the use of all who are engaged in an important phase of the railway industry. The author, first, sketches briefly the history of wagon design and construction and then proceeds to deal with the principles which now govern them; afterwards he goes into the details of the building of various modern types of wagons.

The text is profusely illustrated by photographs and drawings, the latter generally reproduced to a commendably large size and many of them printed on folded inserts. In short, it is a highly instructive book that should be in the hands of everyone engaged or in any way interested in its subject.

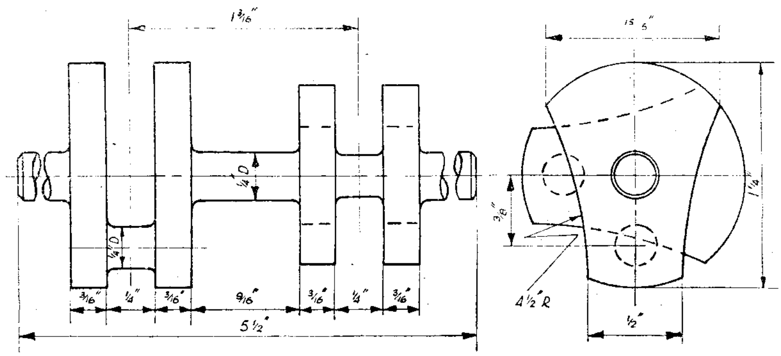
*UTILITY STEAM ENGINES

by Edgar T. Westbury

THE crosshead of the "Warrior" engine is made from a gunmetal casting for convenience, and will give reasonably good service in this material, but if the engine is to be subjected to really hard wear, the extra trouble entailed in making it from solid steel or cast-iron will be repaid by greater durability. If a casting is used, it may be held by means of a cast-on chucking-piece for external turning, facing, drilling and tapping at one setting, finally parting-off from the chucking-piece. To make it from the solid, it is advisable to machine a piece of rod of ample length for both crossheads, to about 1/32 in. over finished size and mill or plane the grooves in both sides, prior to finish turning, drilling, tapping and parting-off each component in turn. For cross drilling the gudgeon-pin hole, it is important that this should be dead square with the axis of the crosshead, and it will therefore be advisable to clamp it to an angle-plate by the machined end-face, and mount the angle-plate on the faceplate. I keep a special small angle-plate for finicky little jobs like this, and mount it on the small driver-plate of the lathe by a single bolt through the driver-stud hole; it is much quicker to set up than a large angle-plate, and ensures accuracy in cross drilling and facing holes in trunk pistons and similar components.



Crosshead, 2 *off, gunmetal or steel*



Crankshaft, 1 *off, mild-steel*

Crankshaft

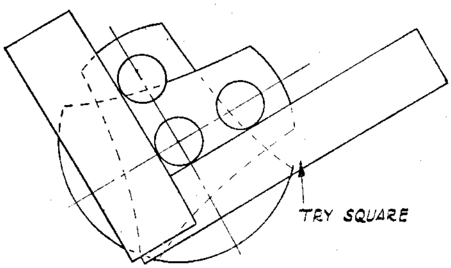
Some constructors have been deterred from undertaking the building of a twin-cylinder engine by the difficulty of machining a two-throw crankshaft. It is true that this job must necessarily involve more problems than those in a single-throw crank, especially one of the overhung type, as used in the "Trojan" engine, which can be built up by simple mechanical methods. But the difficulties of making crankshafts are often greater in anticipation than in actuality, and by using correct methods and due care, even the inexperienced can obtain a satisfactory result with a two-throw shaft.

In a series of articles on "Methods of Making Crankshafts," published in the issues of THE MODEL ENGINEER, dated March 7th and 21st, April 18th and May 2nd, 1946, I gave detailed instructions on various types of shafts and methods of construction. Although these were intended to apply more particularly to petrol engine crankshafts, the same methods are equally successful when applied to those of steam engines. For the type of shaft used in the "Warrior" engine, either machining from the solid or fabrication by brazing are suitable. The former method involves removing a fairly considerable amount of metal, and cannot be rushed, at least towards the end of the operations, owing to the slenderness of the material, and the difficulty of arranging steadies to support it against the pressure of the cut. I have lately encountered some special problems in machining very light shafts in tough material, which have led me to adopt somewhat unorthodox methods of machining, and I propose to explain these in due course. For the present, I would say that turning a shaft of the dimensions shown, between centres, in good quality mild-steel, is quite practicable.

Set out the main and throw centres on the ends of the bar in the usual way, and centre-drill them carefully. Mount the bar on the main centres, and take a parallel cut over the full length, then partly rough out the three main journals, leaving end flanges on to retain the throw centres. Do not reduce the diameter of these journals below about ½ in. at this stage, to retain as much rigidity as possible. Now mount on one of the throw centres and cut out a groove with a narrow tool, traversing it sideways, and proceeding with caution until the crankpin has been roughed out and the sides of the webs

*Continued from page 234, "M.E.," February 24, 1949.

faced to within about 1/32 in. of final width. Narrow side-tools should then be used to finish the webs, and a narrow front-tool, like a long parting tool with the corners radiused, plenty of top rake, and oilstoned to a keen edge, should be used for finishing the crankpin to its correct diameter, plus about 0.001 in. for lapping or polishing. A gap-piece should now be fitted as neatly as possible between the webs—neither too slack, nor so tight as to spring the webs

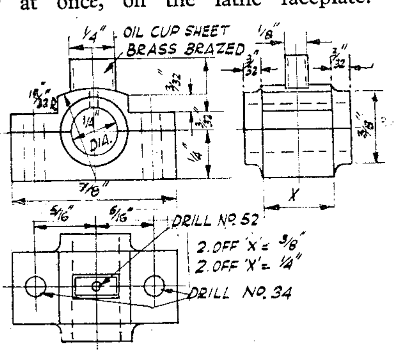


Method of quartering fabricated crankshaft

apart—and secured by a touch of soft solder. This will keep the shaft rigid enough to enable the second crankpin (which it will be noted, is at 90 deg. to the first) to be machined in a similar manner, after which it is also fitted with a gap-piece, and the work remounted on its main centres for finishing the journals to size. The centre journal may tend to spring, but it is possible to arrange a fixed steady to bear on the outside of one of the webs to prevent this, and the same device will be helpful when finishing the end journals.

Fabricated Construction

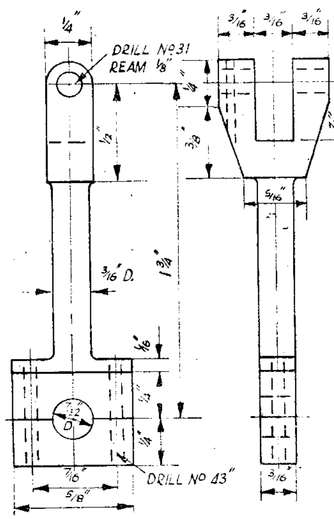
If a brazed-up shaft is used, the discs forming the crank webs may be finished to diameter and thickness, drilled centrally, shaped to form balance weights, and clamped together by a centre-bolt for drilling the crankpin holes through all four at once, on the lathe faceplate. The



Main bearing, 2 off, each size, bronze

journals should all fit the holes fairly tightly, and the crankpins should be made considerably longer than their finished length so that they may be "sighted" parallel with the main shaft on assembly. The two crankpins may be "quartered" (i.e., set accurately at 90 deg.) by a try-square between the centre crank-webs, which should make contact with all three shafts, the main shaft in the angle of the square and the crankpins against each of the blades.

Slight roughening of the shafts at the joint surfaces only, by draw-filing or straight knurling, will assist the flow of the spelter, and a slight countersinking of the webs is also helpful to assist its entry. Paste borax or other recommended flux should be applied locally, not indiscriminately, as it is desirable to avoid the necessity of having to clean off either flux or spelter afterwards. With proper care, it should not be necessary to do more than cut away the superfluous parts of the shafts and polish the journals after brazing. Incidentally, the term "brazing" is used to cover all forms of hard-soldering, and in this case the use of a free-running silver-solder such as "Easy-flo" will be in every way satisfactory, and much easier to apply than high-temperature brazing spelter. A clean flame and ample heat to bring the metal



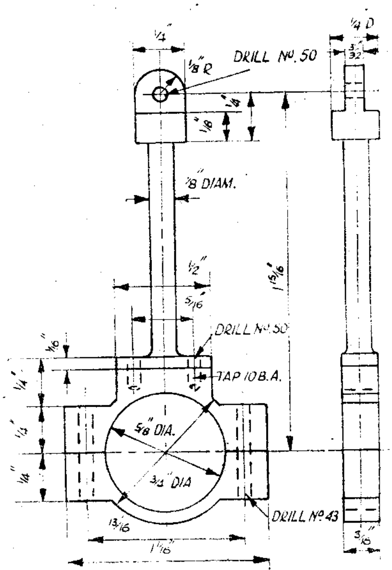
Connecting-rod, 2 off, mild-steel with split bronze bearing

quickly to a bright red heat, without sooting or scaling, are important factors in the success of this operation, together with scrupulous cleanliness of the work itself, and protection from oxidisation by a good flux.

Main Bearings

Strictly speaking, it is only necessary to split the centre main bearing, as all the others can be threaded over the shaft before securing them to the bedplate; but many constructors will find it desirable to split all four of the bearings, so that their lower halves may be secured in place on the bedplate and lined up in the orthodox way before fitting the shaft and assembling the bearing caps. It will be seen that the bearings vary in journal length, but the method of machining and fitting is the same in all cases. Either cast gunmetal or drawn rod may be used, but ordinary brass is not recommended, as it does not give good wear. In the case of split bearings, the upper and lower halves should be machined on the joint face, drilled for the stud holes, and bolted together for boring the bearing. It will be desirable to tap the lower half 6 B.A. or $\frac{1}{8}$ in. Whit., so that temporary screws can be used during this operation, and the lower halves can be secured to the bedplate afterwards by set-screws from the underside. After boring the bearings, they should all be assembled together on a straight piece of $\frac{1}{2}$-in. rod and filed or lapped on the underside so that they will all bed down truly on a flat surface, with the rod exactly parallel with the base line. If this is done, the crankshaft should bed down and run quite freely when fitted in the bearings and the caps clamped down.

It will be seen that rectangular oil cups bent up from thin sheet copper are shown brazed to the bearing caps. This feature is optional, but will be found worth while in ensuring adequate lubrication of the bearings. Round oil cups screwed into the caps are serviceable alternatives, but are not correct marine engine practice.

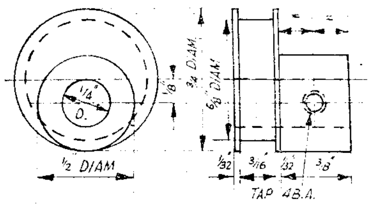


Eccentric-rod and strap. 2 off, mild-steel, with split bronze bearing

Connecting-Rods

These may be turned from $\frac{3}{8}$-in. diam. steel rod, and the ends filed or milled flat on the sides afterwards. It will be found convenient to carry out the turning at one setting, using a piece of rod long enough to serve for a chucking-piece, and parting off when turning is completed. The top end of the rod should be outwards, so that a $\frac{3}{16}$ in. hole can be drilled in the end to save work in drilling or filing out the fork. A line should be incised round the outside to mark the position of the gudgeon-pin hole, thus ensuring its correct location and enabling it to be started from both sides so that it is square with the axis of the rod. Before parting off the rod, it is a good idea to mark the centre-lines of the foot and the fork at 90 deg. to each other, using some means of indexing the lathe mandrel, in conjunction with a scriber or point tool held at centre height in the tool-post.

The split big-end bearings are made in the same way as the main bearings, and care should be taken to see that the bolting faces are parallel with the axis of the bore. They are secured to the foot of the rod by 8-B.A. or 3/32-in. steel bolts with hexagonal heads and nuts.



Eccentric sheave, 2 off, mild-steel

Eccentric-Rods and Straps

The rods are produced in a similar manner to the connecting-rods, but in this case the maximum flange diameter over the foot is only $\frac{1}{2}$ in., and the top end is formed into a tongue instead of a fork. The eccentric strap is made from a gunmetal casting, which is supplied solid but with sufficient metal to enable it to be split and bedded together on the joint faces; this, of course, must be done before machining the bore. Two 8-B.A. bolts are fitted to secure the two halves of the strap, and the upper one is attached to the foot of the rod by two 10-B.A. set-screws.

Eccentric Sheaves

The method recommended for making these is to take a piece of mild-steel bar $\frac{7}{8}$ in. diameter, long enough to make both sheaves, with chucking and parting allowance, and hold it in the three-jaw chuck for facing, roughing out the flanges and grooves, and parting about half-way through in each case. Next, mark out the throw centre on the end face, and re-chuck the bar in the four-jaw chuck, with the throw centre running truly. Centre-drill the end, and drill and ream the hole concentrically at this setting, then turn the boss to size, and part off. This will produce the two sheaves with the eccentric portion part-finished, calling for a final machining operation.

Next, take a metal flange or flat plate and fix a stud in it by pressing, riveting or screwing, leaving a projecting part large enough to machine to $\frac{1}{4}$ in. diameter on one side, but no projection on the other. Mount this on the lathe faceplate with the stud central, and turn it to a wringing fit for the eccentric sheave. The plate is now shifted on the faceplate to throw the pin exactly $\frac{1}{8}$ in. out of centre; this may be measured fairly accurately in various ways, such as by checking the position of the plate before or after setting, or by taking differential measurements from the pin to a fixed point (a dummy lathe tool, for instance) at opposite points of rotation. It may, however, be mentioned that a very slight error in the throw of the eccentric will not seriously affect the efficiency of the engine, though it is obviously desirable to work as closely as possible to the designed dimensions.

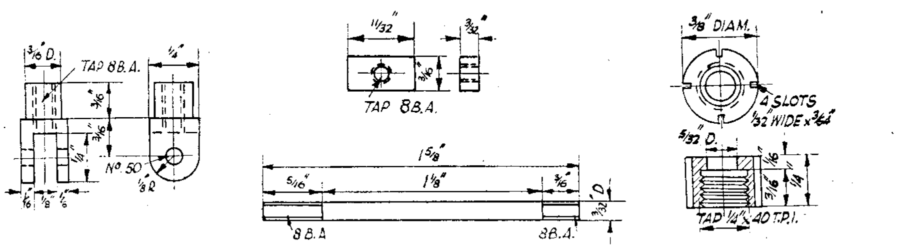
The sheaves may now be mounted on the pin to finish the machining of the flanges and the journal surface. It will, of course, be necessary to rotate them into the position which brings the roughed-out part fairly concentric. It may be desirable to fit the grub-screws in the bosses of the sheaves to enable them to be held firmly against inadvertent movement while machining, or alternatively, the end of the stud may be screwed and fitted with a nut to clamp the sheaves endwise.

This method of machining the sheaves may entail a little more trouble than the usual method of finishing them at two settings, but it ensures positive accuracy in the alignment of the two axes, which is not always ensured by normal chucking methods, especially when the chuck jaws are worn so that they cannot be relied upon to hold work parallel to the lathe centres.

Valve-Rod, Fork, and Nut

These parts are quite straightforward and call for little explanation. The rod is simply a length of 3/32-in. steel rod (stainless for preference), screwed 8 B.A. or 3/32 in. Whit. at each end, the same care being taken to ensure true threads as with the piston-rod. In making the fork, which may be either of brass or steel, it is a good idea to slot the end by means of a slotting cutter or thick circular-saw running in the lathe, before parting the work off. My usual practice in cases where two such forks have to be made, is to machine them at each end of the piece of material, the knuckle ends being outermost, and then transfer them to the tool-post, where they are held at right-angles to the lathe axis, and packed up to centre height. If only round material is available, it is necessary to use a vee packing-block to hold this securely, and after slotting the fork, slices may be cut off the two sides to square them up. The centre hole through the fork serves as a useful guide for centring the slotting cutter; if a saw is used, it will be necessary to take two or three cuts to form the full width of the fork. If desired, the stock may be turned through 90 deg. to machine the edges of the fork afterwards, and the tongue at the top end of the eccentric-rod may be machined in a similar way. All these little dodges cut out a lot of delicate fitting, and I find that they not only save time but also produce a more accurate job.

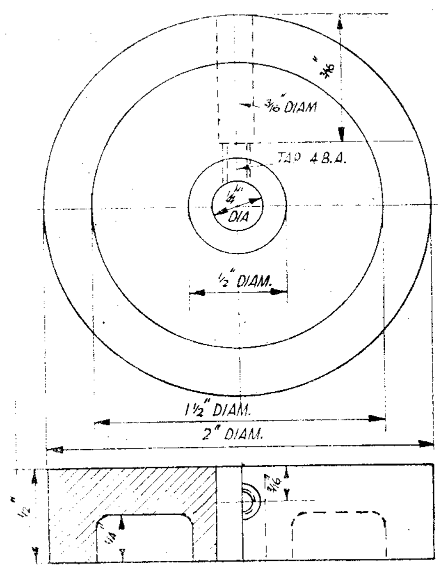
The slide-valve nut is simply a piece of brass strip or sheet, cut to size and tapped to fit the top end of the valve-rod. It should fit the slot in the back of the slide-valve as closely as possible, but should not tend to force either the valve or the rod out of their normal position when assembled. Whereas the fork should be screwed tightly home on the end of the rod, the nut must have latitude for screwing either up or down to adjust the position of the slide-valve.



Valve-rod and knuckle, slide-valve nut (2 off each) and piston and valve-rod gland nut (4 off, brass)

Flywheel

An iron casting is supplied for this, but steel or brass will serve equally well, and it may be found desirable to modify the size or shape of the flywheel to suit a particular purpose or mode of installation. The size and weight of the flywheel are not critical in an engine of this type.



Flywheel, 1 off

It is highly important that the flywheel should run dead truly on its shaft, and be in reasonably correct balance; it should therefore be machined all over, and the final machining done by mounting by the bore on a true-running mandrel.

(*To be continued*)

Old Files are Good Steel

A few suggestions on what to make with worn-out files

by J. W. Tomlinson

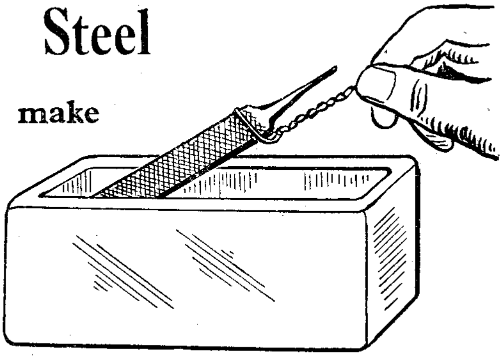


Fig. 1. *Fifteen minutes in hydrochloric acid will give old files new life*

WHEN you buy a file you buy a piece of good steel with teeth on it. When the cutting edge of the teeth becomes blunt, the file, to all intents and purposes, is useless. Many a model engineer has a clutter of old files which he would like to do something with, and it does seem a pity that good steel should just lie and rust, so here are a few suggestions on how to work and make use of old files.

Before we decide to scrap a file, make sure that it is of no further use as a file. I remember how, years ago, we used to immerse worn files in a strong solution of hydrochloric acid for about 15 min. and then wash them in hot water. This gave the file new life, which although not as long as the original one, was sufficient to make it worth while, especially if the file was an expensive one.

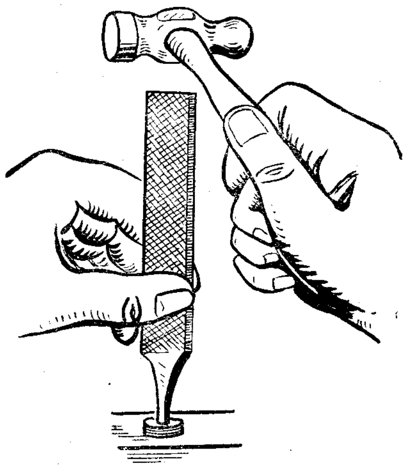


Fig. 2. *Use the side of the hammer when striking a hardened file*

Working of Old Files

The working of old files in their hardened state calls for considerable care. Striking them with hard steel such as a punch, chisel, or hammer will cause chips to fly off with such force as to bury themselves under the skin should they fly that way; and a piece in the eye could prove disastrous. Therefore, never use a punch or chisel on a hardened file, and if a file has to be struck with a hammer, use the soft side to the file, as shown in Fig. 2.

The best way to break a hardened file is to secure it in the vice at a point where the break is required, hang two or three old cleaning rags over it and give the covered portion a hard, sharp blow with the hammer. As the file breaks, the rag will prevent it flying (see Fig. 3).

It will be found that to soften a file sufficiently for normal drilling and filing, it will require more than just getting it hot and letting it cool in air. To make a file reasonably soft it must be cooled off very slowly, and a simple way of doing this is to leave it in the fire overnight. As the fire dies down, the file will be gradually cooled ready for morning. It might be mentioned here that files can be drilled quite easily in their hardened state if a stellite drill is used; and, although these drills are expensive, they may be worth while in some cases.

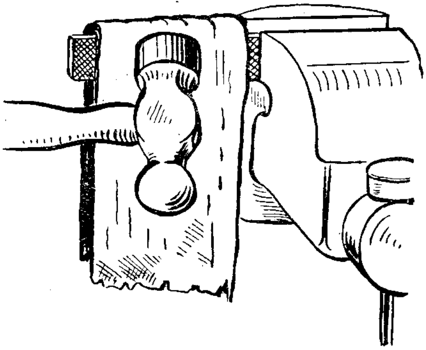


Fig. 3. *Rags over a file will prevent it flying when breaking*

Practical Uses

The model engineer is often called upon to repair things about the house, and usually he can answer the call. Most households using gas, contain some form of gas lighter, a popular form is shown in Fig. 4. The part that ceases to function first is generally the steel portion of the spark producer. This can be replaced in short time, using a piece of 4-in. rough, flat file ground to fit. Often there is at least one section of a disused file that is practically unworn.

As we all know, a file tang is always soft, getting gradually harder towards the file. When a broken stud has to be removed by drilling, the half-hardened portion of the file can be very useful. If it is filed square and driven into the hole in the stud (using the side of the hammer) the broken stud can very often be screwed out.

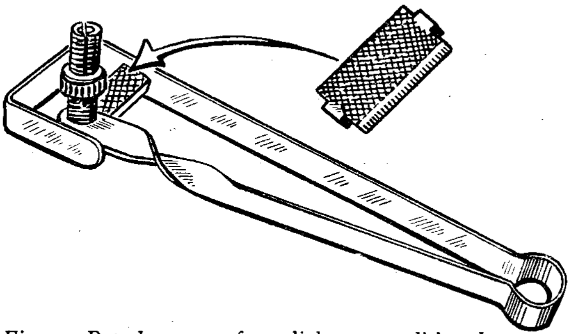


Fig. 4. Popular type of gas lighter reconditioned with a piece of file

Small square files softened in the fire, can be made into Allen screw keys by bending them while hot and filing to suit. Worn-out round files can be made into centre punches by first softening and filing to shape. If they are to be used for punching tough steel, they may need the point hardening. Quite useful taper broaches can be made from small round and square files if the files are softened, filed to a taper with five flats and then re-hardened.

Stud Extractors

The more tools the model engineer has the better, and stud extractors can at times be in very urgent demand. Quite a useful stud extractor can be made out of an old file, as shown in Fig. 6. This tool can also be used for fitting studs by simply turning it over; but, of course, if the studs are tight they will be damaged on the stem due to the teeth digging in. The construction of the tool needs little explanation and the size will depend on the requirements of the individual. A 4-in. file will be suitable for small B.A. sizes, ranging up to a 12-in. file for ½-in. studs.

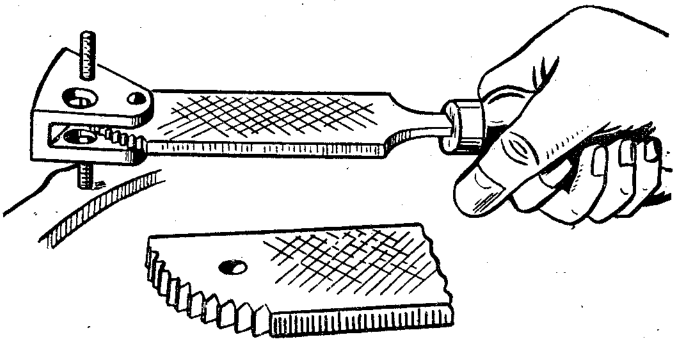


Fig. 6. Stud extractor made from an old file

The file used will have to be softened, drilled, shaped and have the teeth filed on it. The slotted-piece can be made of any good steel, but it should not be hardened. If needed, the tool can be made double-ended, covering a big range of sizes. In order to make the tool less cumbersome, the forked-piece need have only one stud hole. If this hole is located so that the largest stud is gripped at the start of the toothed section, several smaller sizes of studs can be handled. The efficiency of the tool will be improved by hardening and tempering the teeth.

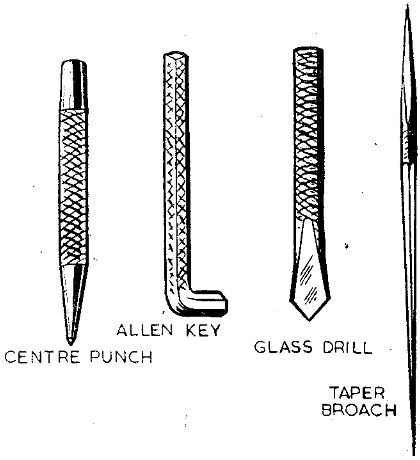


Fig. 5. Four small tools made from scrap files

Countersinks

There are quite a few small hand tools that can be made from old files. Take, for instance, the countersink shown in Fig. 7. This tool may look a bit crude, but you can be assured it works. Dozens like this were used during the war in aero engine factories, and even when properly-made countersinking tools were available, the old file was preferred. They are the simplest thing to make, just grind to the required angle with a bit of rake and leave hard.

Special Punches

Sometimes the model engineer requires a special type of punch, perhaps for driving out a small pin in a shaft, as shown in Fig. 8. You cannot often buy such punches, but they are easily made from old files. The files should be softened and a range of punches made, a short sturdy one to get the pin on the move, and longer ones to follow on with. Having little tools like these handy, often saves hours of fiddling about with a nail or something else that keeps bending.

Chisels

When a ragged bit of metal requires removing from a model casting, and perhaps it is in a corner between a flange and boss (see Fig. 9), what could be a better tool for the job than a small " cow mouth " chisel. These can be made from old round files. They should be softened for shaping and the cutting end re-hardened and tempered, although for most work on small models, re-hardening will not be necessary.

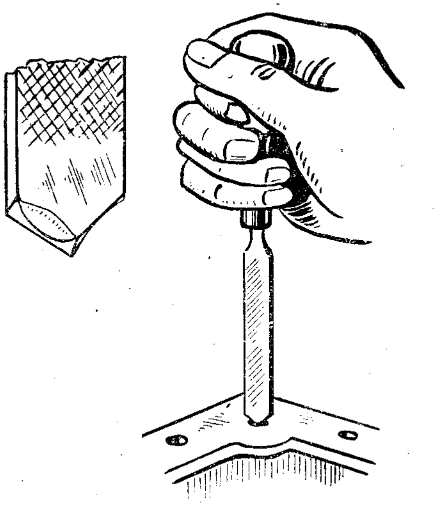


Fig. 7. A countersinking tool which if ground correctly will be very efficient

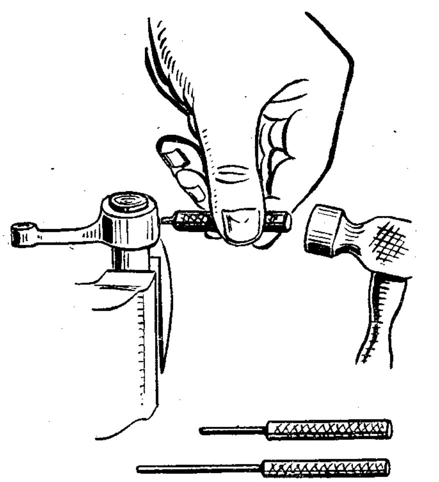


Fig. 8. A range of punches for difficult jobs

Special Files

A little tool used for years by the writer was simply a piece of file soft-soldered to a length of $\frac{3}{16}$-in. mild-steel rod. With this tool, one can get at places inaccessible to even a rotary file fitted to a flexible drive shaft. Fig. 10 shows a good example of its use.

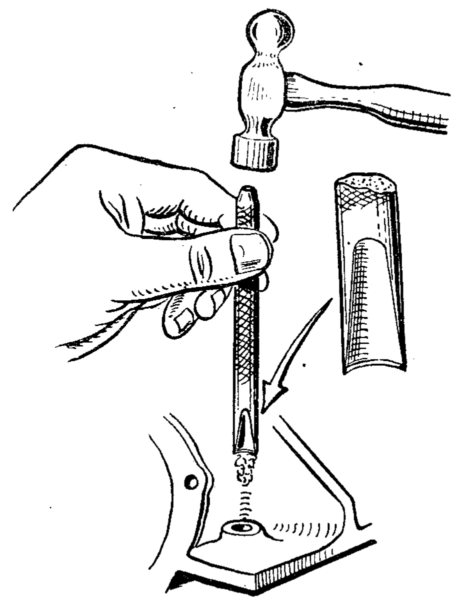


Fig. 9. A " cow mouth " chisel for removing surplus metal

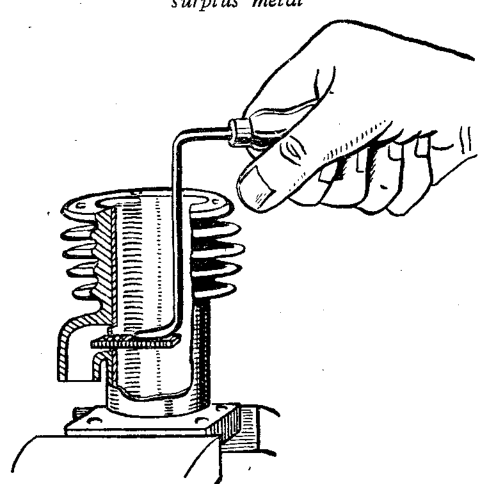


Fig. 10. A piece of file soft-soldered to a length of rod used for filing a cylinder sleeve

Other Tools

There are many other tools that can be made from the good steel of old files. If you examine

(*Continued on page* 288)

A $3\frac{1}{2}$-in. Gauge L.M.S. Class 5 Loco.

by "L.B.S.C."

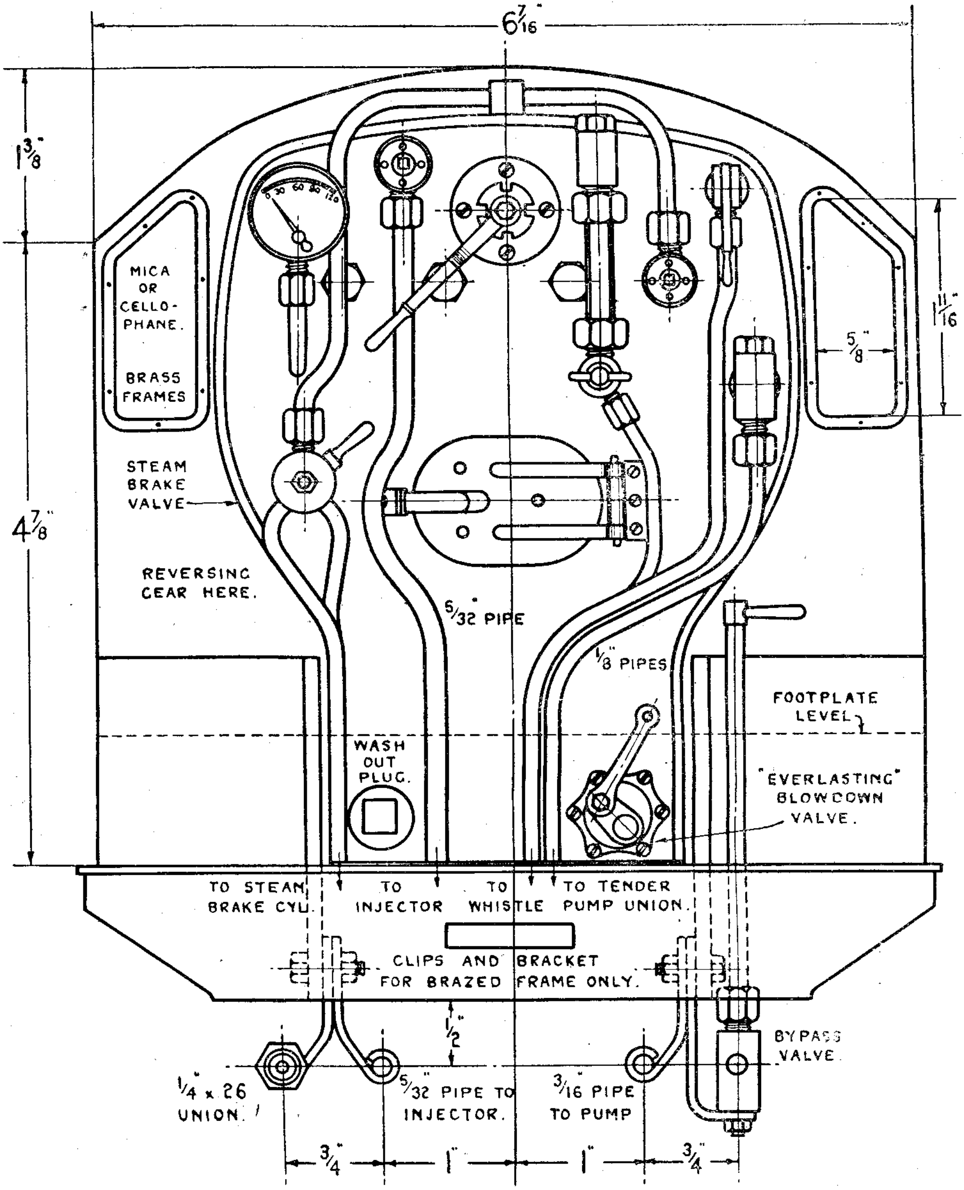
ON drawing out the arrangement of the footplate adornments for "Doris," I find that we can get a much better layout if we make a little variation in their construction and erection ; the reproduced drawing shows how this can easily be done. First and foremost, as the top of the firebox shell comes so close to the cab roof, there is no room for the usual kind of combined turret and whistle-valve, the "standard" kind of fitting which I always specify wherever possible. The only thing to do, is to substitute some kind of smaller fitting from which a pipe can be taken to the blower-valve ; and about the simplest, is a small square block of brass with a spigot for screwing into the wrapper. Two lengths of $\frac{1}{8}$-in. copper pipe are silver-soldered into this, each furnished with a union nut and cone ; the lengths are obtained from the actual job. They are left straight whilst screwing in the fitting, and bent to shape afterwards ; the right-hand one is connected to the blower-valve union, and the other to the steam brake valve. This will be described separately when we get to the brake-gear stage. Brakes, of course, are optional on the engine ; although they can be made to work perfectly, they are useless for "service" stops, as the engine is not heavy enough for "solo" braking.

The steam gauge syphon can be silver-soldered into a similar block of brass, which is screwed into the top left-hand corner of the backhead ; and a separate detailed illustration of this is given, which is practically self-explanatory, so no instructions should be needed for what is really only a kiddy's practice job. The injector steam valve described for "Maid" and "Minx," had a flange for attaching to the backhead by screws ; but the one shown here, is screwed direct into the backhead. The throatplate end of the firebox shell on this engine, supplies steam as dry as in the dome, provided that the steam is taken from the highest point. This can be done by silver-soldering into the injector steam valve, a piece of 5/32-in. pipe long enough to reach almost to the throatplate. Bend up the end of this, directly opposite to the union screw on the valve ; then, when same is inserted into the boiler and screwed right home, the open end of the pipe will be in a place where it can get dry steam.

When making the bottom water gauge fitting, don't put the blow-down union nipple right opposite the bottom gland, but set it a little on the skew-whiff, as shown in the picture. This will allow the blow-down pipe to clear the firehole door sufficiently to allow the door to swing well open. You'll appreciate this when firing the engine on the run.

The actual whistle-valve is made the same way as described just recently ; but it has no union at each side of the ball-chamber. The end cap which holds the spring in place, is made in a manner similar to a safety-valve nipple ; the end of the fitting is threaded, and screwed direct into the top right-hand corner of the backhead. The screwed stem is made to the length shown ; a piece of pipe can be silver-soldered into the nipple, and bent up in the same way as the injector steam pipe. This will ensure that the whistle gets dry steam and blows a clear note instead of a "watery bobble."

A washout plug is fitted down in the left-hand bottom corner of the backhead, and a blow-down valve in the opposite corner. This may be a screw-down valve as shown for the "Maid" and "Minx," or preferably the "Everlasting" valve as fitted to "Doris's" big sisters. I have already described how to make this type of valve, and here you see how it can easily be applied. Chuck a short piece of $\frac{3}{16}$-in. copper tube in the three-jaw, and screw about $\frac{3}{8}$ in. of it with a $\frac{3}{16}$-in. by 40 die in the tailstock holder, squeezing in the adjusting screw of the die, so that it cuts full size. Cut off $\frac{5}{16}$ in. of the screwed part, and screw half its length into the inlet hole in the "Everlasting" valve, on the opposite side to the lever. Drill a 5/32-in. hole in the bottom right-hand corner of the backhead, just above the foundation ring and tap it $\frac{3}{16}$ in. by 40. Anoint the projecting bit of screwed tube on the valve, with a little smear of plumbers' jointing, and screw home. The position should be as shown in the illustration, so that when the boiler is erected, the valve will just clear the frame, and the handle will project through the footplate, a slot being cut for this purpose when the footplate is eventually fitted. Bend another bit of $\frac{3}{16}$-in. tube to a nice sweep—it won't kink if you use finger pressure only—screw the end, and fit it to the outlet hole of the valve, so that the end points down, or a little to the side, whichever you prefer. Then, in districts where the water contains chalk, lime, or other impurities, the boiler can easily be kept clean. Run the fire right down, until there is only about 20 lb. on the "clock" ; stand clear of the pipe, and "open her up." By the time she quits blowing, there won't be any "muck" left in the boiler ! However, be careful not to open the valve when the engine is running—a warning which reminds me of another exploit of a Southern "spam can." These engines are fitted with scum cocks, which require to be opened every now and again whilst the engine is running, to keep the boiler clean. Just recently when nearing Ashford, the scum cock on one of the "spam cans" refused to shut after being opened ; result, the train came to a stand, with the boiler completely emptied. The fireman did his best to throw out the huge mass of burning coal which these engines need to keep them on the run (they can lick the old L. & N.W.R. "Precursors" for coal consumption any day !), but he could not

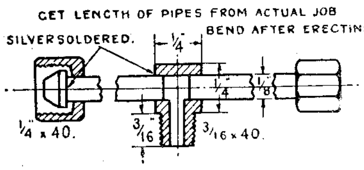


Footplate fittings for "Doris"

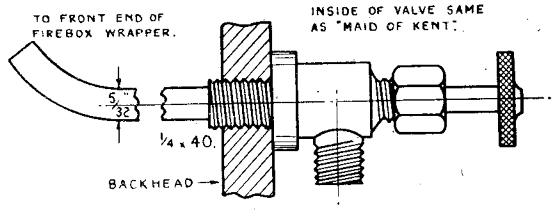
save the firebox. It is interesting to speculate on what would have happened if the lagging had caught alight at the same time, as it frequently does.

Three Fires on One Engine

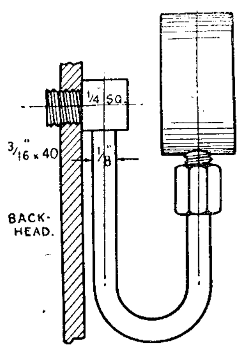
That also calls to mind an adventure of one of the old L.B. & S.C.R. "Vulcans." As I have previously stated, these engines were nothing to write home about, but the heroine of this tale certainly showed plenty of pluck! The poor old thing was plodding along to the best of her ability with all the regulator, nearly all the lever, and a jimmy in the blastpipe—which naturally "sent the rockets up," as the enginemen call it. She was nearing the end of her weary journey, and the smokebox had plenty of "char" in it; half-burnt stuff which catches alight like tinder if it gets any air. It had piled up against the smokebox door, and the same being extra hot, it began to "warp," as we used to say, and some air got in. Some of the "rockets" fell among the char, and presently it took fire. You don't need telling what the top of the chimney then looked like; the smokebox door became red-hot, and then to crown all, the boiler lagging caught alight under the cleading plate. The poor old girl thus had three fires going—one in the firebox, one in the smokebox, and one around the boiler barrel! The driver said she didn't half steam for a little while. Anyway, she struggled home; I recollect the sorry sight she presented next morning, with every scrap of paint burnt off the boiler cleading, ditto the front of the smokebox, and the door so badly distorted that I could very nearly get my fingers between door and smokebox front at the bottom.



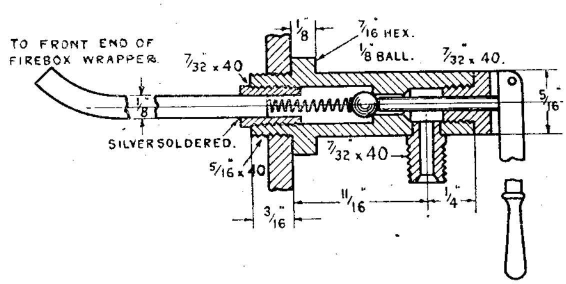
Simple turret



Injector steam-valve



How to fit steam gauge



Whistle-valve

Engine and Tender Connections

To save both time, and a separate drawing, I have shown in the one illustration, the arrangement of pipe connections normally specified for any 3½-in. gauge engine of my own design or build; the spacing may, of course, be varied a little in any direction without upsetting the convenience of being able to couple any engine to any tender, the hoses being flexible, and the hand-pump pipe on the tender, of necessity, is springy. The clips shown, are suitable only for an engine in which the frames have been brazed into the slots in the drag-beam. If angles have been used, the clips will have to be arranged a little differently, or else plate brackets used to support the pipes; details of these will be shown along with the piping diagram. As regards the pipes shown running down the backhead, the same remark applies, as to "Maid" and "Minx"—keep them neat and tidy! Although the fittings are attached to the backhead whilst the boiler is still off the frame, the pipes are not put on until the boiler is erected, with the exception of the bend screwed into the outlet hole of the "Everlasting" blow-down valve; you can't turn it whilst the boiler is in position, unless the bend is exceptionally sharp.

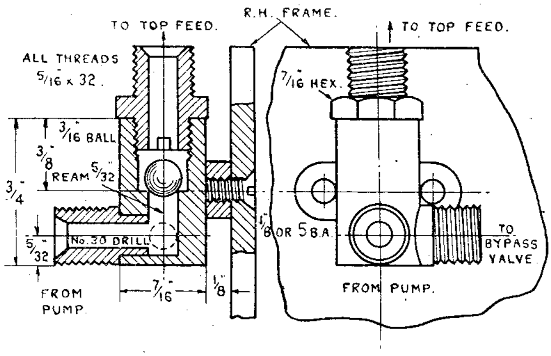
The illustration also shows the shape, and gives dimensions of the cab front; and, as will be seen, all fittings and mountings are clear of the cab windows. These are glazed with mica or cellophane, secured by brass frames and weeny screws, or rivets made from domestic pins. The front may be made any time you wish, but is not fitted until the engine has been tested on the road and all adjustments made. Get her to do the job O.K. before you think about decorating her up!

Delivery Clack for Top-feed

"Doris's" big sisters all have top-feeds, so we will follow suit on the little one; personally, I prefer top-feeds, and have fitted them to "Tugboat Annie" and others in my "running-shed." I thought at first of following full-sized practice, to the extent of putting the top clacks actually in the casing on top of the boiler, and schemed out a simple arrangement whereby this could be done; but the trouble was, that it would have been a rather ticklish job drilling the waterways without doing a bit of inadvertent "short-circuiting" (thanks, Milly!) so it was abandoned in favour of a plain top fitting with only two simple waterways in it, plus a separate clack, with union for bypass pipe, attached to the right-hand frame just ahead of the weighbar shaft. The exact position doesn't matter; anywhere within reason will do.

The clack is made from a ¾-in. length of 7/16-in. rod, bronze or gunmetal for preference, and as the *modus operandi* of forming the ball-chamber, valve-seat and cap is exactly the same as in the feedpump, and other fittings, there is no need to detail out the whole ritual again. One

5/32-in. by 32 union screw is silver-soldered in at 5/32 in. from the bottom, to admit water below the ball-valve, see section; another ditto is put in also at 5/32 in. from the bottom, but at right-angles to the previous one. This is connected to the bypass valve under the footplate, by a 5/32-in. pipe. The boiler feed goes out through the cap, which is connected to the right-hand top feed by a $\frac{3}{16}$-in. pipe, furnished with nut and union at the lower end, and silver-soldered into the top-feed fitting at the upper end. To attach the clack to the frame, cut a piece of $\frac{1}{8}$-in. by $\frac{5}{16}$-in. or $\frac{3}{8}$-in. brass rod about 1 in. long; round off the ends, tie it to the clack body with a piece of thin iron binding wire, in the position shown in the illustration, and silver-solder it at the same heating, when doing the two union fittings. A casting may possibly be available for this gadget, as one or two of our enterprising advertisers make castings for all my little fittings, where they consider that the use of a casting saves time and labour—and, maybe, a little railroad Esperanto as well!

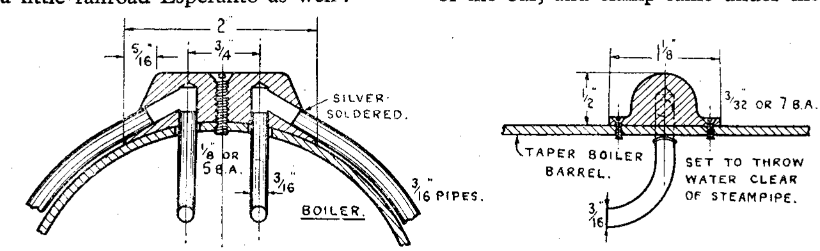


Delivery clack with bypass connection

To erect the clack, merely drill two No. 30 holes about $\frac{5}{8}$ in. apart, and $\frac{3}{4}$ in. or so below top of right-hand frame, anywhere ahead of the weighbar shaft; countersink them, then hold clack in position, and locate the holes on the fixing flange with the No. 30 drill put through the holes in frame. Drill No. 40, tap $\frac{1}{8}$ in. or 5 B.A., secure the fitting with two countersunk screws, and connect the inlet union screw with the one on top of the pump valve box, by a bit of $\frac{3}{16}$-in. pipe with union cones and nuts on each end. A 5/32-in. pipe could be used, if very thin-walled, say 26-gauge or thereabouts.

Top-feed Fitting

If our advertisers can supply a little casting for the top-feed fitting, to the correct shape of the casing over the top clacks on the full-sized engine, Inspector Meticulous will surely award him a medal. Otherwise, file up a bit of brass bar to the approximate size and shape shown. Personally, I would just use a piece of $\frac{1}{2}$-in. by $\frac{3}{4}$-in. bar 2 in. long, bevelled at the ends, rounded off at the top, and saddled to fit the boiler barrel. I made a fly-cutter spindle for my milling-machine some time ago—recollect the tale of the square tool in the round hole?—and a cutter set with its edge $2\frac{1}{8}$ in. from centre, would make short work of cleaning out the radius in the piece of bar, held upside down in the machine vice on the miller table. "Lathe-only" users can get the same result by improvising a cutter spindle. Just drill a cross hole about $\frac{5}{16}$ in. diameter near the end of a bit of $\frac{3}{4}$-in. round mild-steel about 3 in. long, and put a $\frac{1}{4}$-in. set-screw in the end. Use one of your $\frac{1}{4}$-in. square lathe tools (a round-nose for preference) in the hole, with the cutting edge set $2\frac{1}{8}$ in. from centre. Hold the bit of round steel in the three-jaw. Either set the piece of brass bar in a machine-vice bolted to the lathe saddle, or to a vertical slide; or else solder a bit of square rod to the middle of the top of the narrower side of the bar, and clamp same under the slide-rest tool-holder, so that the part to be machined, is presented to the cutter. Feed in about $\frac{1}{16}$ in. at a time, and traverse the saddle or top slide so that the piece of brass bar moves across the revolving cutter. You'll soon get a perfect saddle. I did all mine that way before I had a milling-machine.



Top-feed fitting

In the saddled part, drill two holes with No. 14 drill, at $\frac{3}{4}$ in. centres, going within $\frac{1}{16}$ in. of the top of the block. Then drill two holes in the sides, to meet them. These holes must be drilled at an angle, as shown, otherwise the feed-pipes won't lie flat on the boiler barrel. In case beginners wonder how the merry dickens they are going to start the drill in the right direction at such an angle, they don't have to tackle such a problem at all, as the holes can be drilled before shaping the block. Just leave the ends of the block square, make a good centre-pop, drill straight in until the point of the drill has just entered to its full diameter, then incline it over to the correct angle, and go ahead until the drill breaks into the vertical hole. Finally, file the block to shape, and there you are, as the old horse-cabby is reputed to have remarked when his horse fell down and one of the cab wheels came off.

Fitting Pipes and Erecting

Drill a No. 30 hole down the centre of the fitting, and countersink it. If a casting is used, there will be a flange in the middle ; and instead of the hole just mentioned, drill two No. 40 holes in the flange, for the method of fixing shown in the cross-section. Make two bends from $\frac{3}{16}$-in. pipe, also shown in cross-section. To get the lengths of the longer feed-pipes, from the injector on the left, and the delivery clack on the right, stand the boiler temporarily on the chassis, and measure the actual distances with a piece of soft copper wire. I use thick lead fuse-wire. The right-hand pipe goes straight down, around the boiler barrel (Pat again !) to the top union of the delivery clack. The left pipe follows the curve of the boiler to running-board level, then curves backwards, runs along at same level until it reaches the end of the boiler, where it turns down to connect with the clack on the end of the injector. The latter will be described, all being well, in the very near future.

Cut the pipes to the ascertained length, and fit them, also the two bends, to the top-feed fitting, silver-soldering the whole four at one heat. Next, at $2\frac{1}{4}$ in. from the centre-line of the dome, and $\frac{3}{4}$ in. apart, drill two $\frac{3}{16}$-in. clearing holes in top of boiler barrel. Use 13/64-in. drill. Clean the top of the barrel all around the holes ; then insert the bends, and seat the fitting well down on the barrel. This can be done whilst the boiler is still temporarily in place, and the pipes can be bent approximately to their final shape. Run the No. 30 drill down the screw-hole, countersinking the barrel, follow with No. 40, tap $\frac{1}{8}$ in. or 5 B.A., and secure the fitting with a brass screw ; or if a casting is used, secure by the two smaller screws, locating, drilling and tapping in similar manner. Apply a brushful of Baker's fluid or other liquid soldering flux all around the fitting, put a bead of solder at each side, and direct the flame of your small blowlamp or gas blowpipe on the fitting (keep off the dome !) until the beads of solder melt, and sweat in under the fitting, making a perfect and neat seal. The heads of the screws can also be soldered over.

There isn't the least objection to making the joint permanent, as it never has to come off again during the lifetime of the engine ; and even in an emergency, such as a bad collision, or a fall from an elevated line which results in damage to the boiler, it isn't a hard or difficult job to melt the solder again. I find that the solder seal is neater and far more efficient than soft gaskets for top-feed joints, and use the same on my own engines, for example " Tugboat Annie " and " Cock-o'-the-North." Should any builder object to making the injector delivery-pipe in one length as specified, there isn't the slightest objection to a union being introduced at any desired point in its length ; but here again, I only " preach what I practise," and find the long pipes quite satisfactory, as they offer the least resistance to the flow of water. Next item will be to erect the boiler and connect up.

Old Files are Good Steel

(*Continued from page* 283)

the tools of a metal fettler, you will find that most of them are made from old files. Similar tools can be most useful for removing carbon from the ports of internal combustion engines, as shown in Fig. 11.

Drills for piercing glass as shown in Fig. 5, and even parting-off tools for use in the lathe, are within the scope of the old file. One old-timer I knew as a boy, used to make practically all his lathe tools from old files. Of all the tools made from this steel, I should think bedding scrapers are the favourites. I have made scrapers from " magic steel," ball-races, and all kinds of steel, but I think that if you can get a file just right, it takes some beating. For scrapers, hardening methods vary from sticking the finished scraper, red-hot, into a potato, to immersing it in sulphuric acid. The method of making scrapers from files is too well known to need mention here.

In conclusion, it is not suggested that the model engineer should equip his workshop with tools made from old files, but there are times when an old file will fill the gap, especially when dealing with special tools, and as mentioned at the beginning, it does seem a pity to see such good steel going to waste.

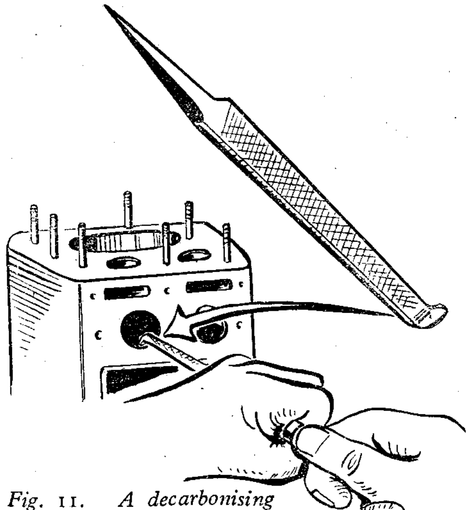


Fig. 11. *A decarbonising scraper made from a half-round file*

From One of Your Readers

by G. R. Muirhead

(In our " Smoke Rings " for February 3rd last, we referred to this long and interesting letter, stating that we intended to publish it in full. Here it is, without apology ; and it speaks for itself.—Ed., " M.E.")

I HAVE never before presumed to encroach upon your sanctum, but, being by myself this evening, and reading your editorial of January 6th, I cast my mind back to the time when THE MODEL ENGINEER first came into my hands, and how, one way or another, it has been instrumental in guiding my footsteps. However pleasurable or gratifying a job may be, a few words of appreciation from time to time are a great stimulus, and it was with that intention that this letter was started.

First, a word of regret at the loss last year of your Chief, Mr. Percival Marshall. I never met him in person except through the pages of THE MODEL ENGINEER ; but that was sufficient to indicate, to some extent, the character and personality of the man, and perhaps, in some small degree, to appreciate your loss. Even so, I feel sure that he has left his paper in good hands, and that the high editorial standards that he set himself will be maintained.

Referring back to when I first came into possession of THE MODEL ENGINEER, it was at school. A classmate produced a few odd copies which he loaned me, and which I read from cover to cover—advertisements included. I can't offhand remember the dates, but " Fayette " was on the stocks, and " Ayesha " a comparatively young lady ! These odd copies finally came into my possession, probably at the cost of a few foreign stamps, or, perhaps, cigarette-cards. Anyhow, they now recline in one primitive cover, the first attempt at book-binding, among other kindred volumes.

It was not long after that that the much-cherished " Meccano " sets were replaced by a $2\frac{1}{8}$-in. Portass lathe on a lean-to stand, complete with treadle and self-centring chuck. All second-hand, I may add, as the price obtained for the " Meccano " would not cover the cost of a new lathe. As a Christmas present, my father gave me a set of Bond's mill-engine castings, with the cylinders and flywheel ready-machined. Not an impossible job for anyone already past the " Tyro " stage ; but for yours truly, with only enthusiasm and the knowledge of lathe work gained from books (again THE MODEL ENGINEER series), it was a bit of a headache. Nor was there anyone to ask for advice.

We lived, and still do, on a farm, with the nearest town four miles away. The only job done outside, was to have the bed trued up. The secrets of file, scraper and surface-plate, at that stage, were much the same as a conjurer's tricks. Here the local agricultural implement repairer's services were called upon, not, I may add, without some regret. Anyhow, by first learning the rudimentary art of grinding and setting up tools for turning, and trying them out, first on plain brass and mild-steel stock, and then, eventually, on the castings, all the bits and pieces finally took form. Drilling, done on the lathe, and tapping, both provided their own particular headaches. But, with what I considered a minimum number of breakages, the engine was at length ready for assembly, and I had the ample satisfaction of seeing it working under compressed air. I still have this engine in its original condition. One day, perhaps, it will be rebuilt, and the pump unit fitted, as, when first made, this was omitted in favour of the plain guide to the slide-valve. Should anyone ask my advice on learning lathe work (very unlikely !), I would recommend a small treadle-lathe as ideal for plain turning, since the amount of power it is possible to transmit to the mandrel is so limited ; the tools have just got to be ground and set correctly, if you are going to get anywhere at all ! Also due to the sensitivity on both the slide-rest (traverse and facing), and on the drive, being manual, you can " feel " when your tools are cutting properly. It is strange what small things can give pleasure. I still get a " kick " out of seeing the swarf curling away nicely when either turning or drilling.

Since reading those first few copies, I have been a constant subscriber except for two enforced lapses. One soon after I left school, and more recently due to the war, when things were so uncertain, and I was overseas part of the time.

THE MODEL ENGINEER has been instrumental in getting me a job in one of the best-known aircraft factories in the country as a fitter, and while there to be able to use machine tools which were " taboo " to the normal line of trainees. After hours, I used to ask permission to use certain of the milling and planing machines which were not on regular production jobs.

During the war, a belated Flight-Engineer out in West Africa had given up the idea, on one occasion, of ever getting the auxiliary power unit on a Sunderland aircraft ever to function again. I think the heat, humidity and flies were too much for him, and he was ready to try anything. Officers, as a rule, are accepted as being pretty duff when it comes to a practical job of that nature, but as I was second pilot on this particular aircraft, and it was my responsibility to see that it was refuelled and signed up as serviceable, something had to be done about it. With some temerity, as I had never before seen one of these units in pieces, I said I would have a look at it, as the possibilities of getting an engineer from ashore in reasonable time, under the conditions in which we were working, were pretty remote.

Still, it is surprising what one can do if one tries, and as it happens, luck was with me on this occasion (otherwise there would be no point in writing this, would there ?). The timing on the engine had been disarranged, and, as the unit is

(Continued on page 292)

A Successful Sound Projector

by W. H. Churcher

IT was something like old times to read the interesting article by "Kinemette" on cine projectors in THE MODEL ENGINEER, in which it was stated that the time is not ripe to describe a sound projector owing to the difficulty of obtaining the necessary bits and pieces, and the price thereof. I am inclined to agree, but think that price is the prohibition factor. Optics and P.E.Cs. can be purchased without much difficulty; in fact, most of the equipment necessary to construct a sound unit. The cost of these essentials is beyond the means of the average would-be home sound projectionist.

The photographs and description herewith are of a sound projector which was commenced in 1939 when, at a reasonable cost, I purchased some of the castings for THE MODEL ENGINEER projector. I had machined the gear-case, motion housing, cam, etc., when hostilities brought my efforts to a sudden stop at this stage.

In 1942 things had quietened down. I was attached to a works N.F.S. crew and decided to build a 9.5 mm. sound projector to provide a little entertainment when on night duty. This meant that the outfit must be easily transportable and capable of a bit of rough handling. A design was laid out incorporating projector and amplifier in a carrying case, the loudspeaker to house spool-arms, spools, etc. This idea worked very well and the fact that the projector can be completely closed up when in operation makes for quiet running, which is an advantage, especially in a small room. The previously machined gear-case and motion housing had to be modified to suit the new arrangement, also the spool-arm. Castings could have been dispensed with had they not been to hand. All gears are 48 d.p., the 8-to-1 reduction gear is fibre, and cam and bridle are to THE MODEL ENGINEER design. They have stood the strain well without signs of any serious wear. A double claw is fixed to the bridle, but it was found necessary to spring-load this unit to ensure reasonably quiet running at 24 f.p.s. A two-blade light shutter approximately $2\frac{1}{8}$ in. diam. operates between the objective lens and film gate. The condenser cowl on the lamp house must be slid out of position before the film gate can be opened to thread up a film, a safety precaution should the projection lamp be accidentally switched on. An Osram E.L.4 10-V

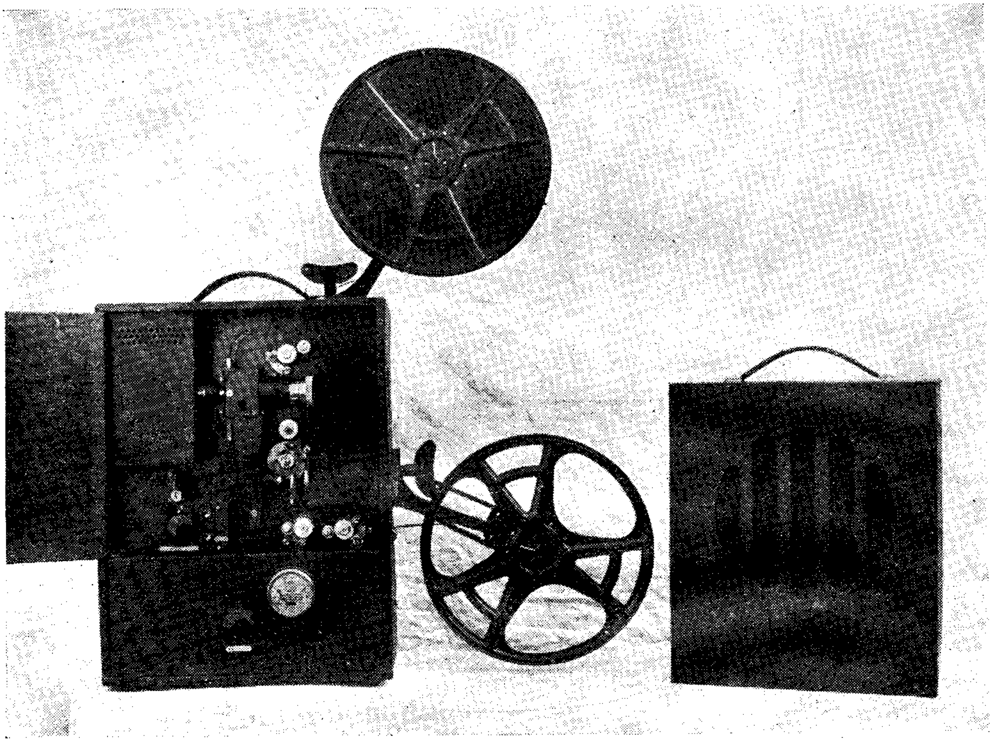


Photo No. 1. The projector and speaker

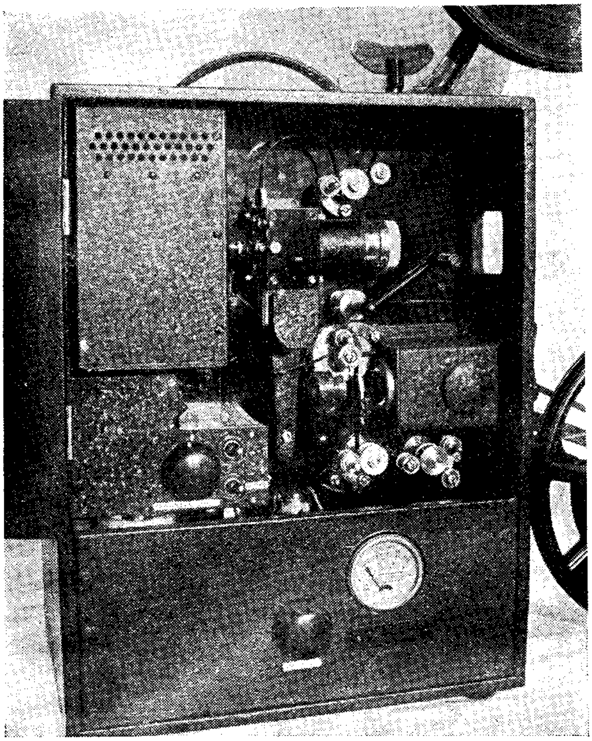


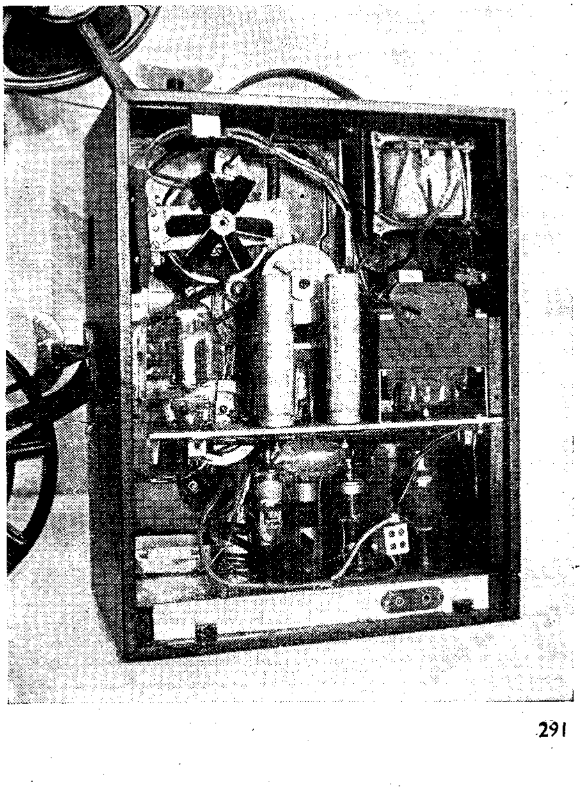
Photo No. 2. *General arrangement of the projector*

5-amp. exciter lamp is used for projection. (To any readers who have not tried this type of lamp, I can recommend it; the filament is horizontal and focuses well into the film gate, and the illumination is excellent for a 50-W lamp.)

The projector is driven by a small induction motor. After many unsuccessful attempts to purchase a suitable motor, I decided to try my hand at making one. The stator is made from the rotor of a blitzed a.c. motor, the required number of laminations being riveted together, turned, bored and drilled. A hacksaw and file, plus a little elbow grease did the rest. The rotor laminations were obtained from an old dynamo armature and locked on to the motor spindle with a $\frac{1}{8}$-in. thick brass disc at each end, after turning to size 15 equally-spaced holes drilled close to the periphery and a copper bar inserted in each. At this stage the locking nut was slackened to allow the copper bars to be slewed round a little, thus giving them a lead in relation to the motor spindle. The lock-nut retightened the bars and the end discs were then brazed up solid.

The final operation was to machine the brass discs away, leaving about $\frac{1}{16}$ in. each side of the bars to act as short-circuiting rings. After making bearings and endplates, four coils were wound with 600 turns in each, copper lagging added to the stator for starting, and the job assembled and tried out. The motor would usually start the projector at 16 f.p.s., but just refused to oblige at 24 f.p.s. without assistance. This performance, though disappointing, was not altogether unexpected. When the lagging bands were removed, the motor ran rather hot, so new coils were fitted with 750 turns in each. The method of starting is to turn the handle by hand and switch on the motor while turning. When the machine is running, the handle is removed; this method of starting has proved quite successful, the motor running quite cool and steady without any sign of wow from the sound. A twin V-pulley is fitted to the motor, the large diameter pulley driving the intermittent shaft at 1,440 r.p.m. and the smaller one at 960 r.p.m. It takes only a few seconds to slip the spring wire belt from one pulley to the other when changing from silent to sound or vice versa. The sound system used for scanning is a projected track and, although not so compact as projected slit, fits into my layout quite well, and does not require

Below—Photo No. 3. Rear view with back cover removed



the expensive high-grade optical unit used with projected slit. The exciter lamp is a 12-V, 36-W V-filament car headlamp bulb, which is focused through a ⅞-in. diameter condenser lens on to the sound track through a 0.035 in. diameter hole in the sound gate. The objective lens in front of the sound gate projects an enlarged image of the sound track on to the slit. A vernier adjustment is fitted to allow the slit width to be varied from 0.001 in. to 0.010 in., thus providing a quick means of adjusting the slit width to suit lenses of different focal length used when experimenting.

A little adjustment will also often improve the balance and tone of a particular film. Although quite a cheap lens will give tolerable reproduction, a good quality lens is an asset; the one I used is a 20-mm. F/25 anastigmat borrowed from my 9.5-mm. cine camera. The higher definition of this lens give a good top response and makes speech quite crisp. The P.E.C., a Yankee miniature with head-on cathode, is an efficient little cell mounted on a small spiral of 20 s.w.g. wire, having one end soldered to the anode connection on the cell and the other end fixed to the metal cell cover, making an earth connection. Thus the cell is free to float about within reasonable limits. It is completely anti-microphonic and projector vibration is effectively damped out. The amplifier consists of two 6J7 Mullard H.F. pentodes and a K.T. 66 Osram output valve, and the circuit is quite straightforward, calling for no explanation. It was found necessary to rubber-mount this unit, and anti-microphonic valve holders also proved an advantage. It is amazing how P.E.Cs. and amplifiers will pick up unwanted noises and vibrations in preference to the required signal. The power pack is a separate unit mounted above the amplifier on the gear-case side of the projector.

The power pack mains transformer was purchased new, the projection lamp and exciter lamp transformers retrieved from wireless junk and wound to suit. The transit of the film through the sound unit may be of interest. After leaving the projection gate, the film passes over a roller to which a small flywheel is attached, thus damping out flutter from the intermittent motion of the film. A spring-loaded felt pad presses very lightly on to the flywheel, the tension being just enough to prevent overrun and keep the film in contact with the sound gate. The main steadying roller with 3-in. diameter balanced flywheel is mounted underneath the gate, and after leaving the steadying roller, the film passes over the take-up sprocket and on to the lower spool. Both film gates, all guide rollers and sprockets are relieved, to ensure safe passage of the film. The emulsion side of the sound track does not come into direct contact with any part of the machine.

This precaution has payed dividends; my test film, a "Popeye" cartoon, has been through literally hundreds of times and is still in good condition. The projector has done some real hard work, both silent and sound, and was in constant use until the end of the war. Provided the outfit is used within its limitations with regard to illumination and sound output, it will give quite pleasing results.

The photographs were taken about five years ago, some minor alterations having been made since. No. 1 shows projector and speaker together. No. 2 shows general arrangement. The P.E.C. unit is on the left, including light and motor switches, with slit adjusting knob above the cell volts control, and exciter lamp house on the right. No. 3 is a rear view with back cover removed, showing rubber-mounted motor, power pack, etc. The exciter lamp transformer was not fitted when this photograph was taken.

From One of Your Readers

(*Continued from page* 289)

installed, there is no possibility of seeing when either of the ports is open. Again THE MODEL ENGINEER came to the rescue. I vaguely remembered reading how someone had used a mirror to enable him to do some tricky piece of adjustment, and with the help of a chromium-plated shaving mirror, watching for valve openings and remembering the normal advance on a high-speed engine, we were lucky to get the unit running satisfactorily the first go! As I said—luck—but who knows? The aircraft was able to carry out its scheduled patrol. Maybe that odd tip in your paper was instrumental in saving loss of life and valuable cargo amounting to, perhaps, thousands of tons, from the convoy that was enabled to receive its air escort.

Today, as a help to my father, the knowledge picked up through your journal has a very practical value. Repairs are expensive, however trivial, and the little 3-in. lathe bought before the war (and, incidentally, the best £5 value I have ever had) is very frequently brought into service. Odd American-sized bolts and studs, unions, special washers, truing valves and guides are all taken care of and many more things besides.

If anyone should ask if a model engineer has a place on a farm, you may with confidence assure them that he has. There seems a tendency for farm machinery to get much more diverse and complicated. But then, farming is a challenge—a challenge against nature in the main, and the machinery is there to help on the farmer's side; but for the model engineer, the machinery is a challenge—to keep it serviceable, and to use his wits to keep running repairs within the scope of a 3-in. lathe! The best effort to date was the truing-up, *in situ*, of a car crankshaft, the owner of which refused to have a reground one installed; but that is another story.

Well, these few lines indicate, I hope, in some degree, how THE MODEL ENGINEER has found a place in the home of just one of your readers. I hope also that you have been interested and encouraged.

IN THE WORKSHOP

by "Duplex"

*32—Attachments for the Back Tool-post

THIS drilling attachment, which is secured to the base of the standard form of back tool-post already described, is used for drilling and machining components carried on the lathe mandrel.

The axis of the drilling spindle is set at the centre height of the lathe and parallel with the lathe axis; the latter provision is essential, as the feed motion is imparted to the drill by the forward movement of the saddle on its guide-ways.

In this connection, the correct location of the base of the tool-post is determined by the register pegs already fitted to its under surface and engaging the rear face of the cross-slide; whilst the position of the drilling turret itself is maintained in the axial line by means of a register-pin, as in some of the other patterns of turrets previously described.

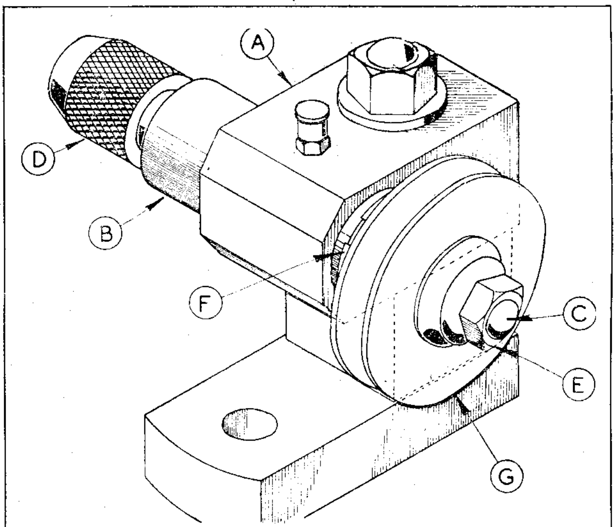


Fig. 1

It follows, therefore, that this appliance will drill holes at the lathe centre-height and at any radius from the centre within the capacity of the cross-slide travel; in this way, division plates, engine cylinder-covers, and similar components can be drilled with the aid of an indexing device controlling the rotation of the lathe mandrel. In addition, if a small end-mill or other type of rotary cutter is mounted in the drill chuck, radial slotting and grooving can readily be carried out, as when forming the teeth of extemporised circular milling-cutters or shaping the curved recesses at the periphery of finger-nuts and wheels.

As will be seen in the drawings Figs. 1 and 2, the body casting (*A*) is cross-bored to accommodate the cast-iron drill sleeve (*B*) which, in turn, carries the drilling spindle (*C*), driven by the V-pulley (*G*). As the turret-head will remain in one position when in use and will not have to be rotated from time to time, as in the case of a two-station turret, a central, hexagon clamping-nut and washer are used instead of the handled nut previously employed.

Oil is supplied to the spindle by means of the spring-top lubricator fitted to the upper surface of the body casting, thence the oil travels to the rotating spindle by way of the annular groove and radial holes formed in the sleeve.

The sleeve (*B*) is secured in position in the body casting by means of the slotted ring-nut (*F*). The drill spindle (*C*) is formed parallel throughout its length, and, when the bearing surfaces are accurately lapped to ensure a well-fitting but free-running assembly, no provision for taking up wear will be found necessary, particularly as the spindle is intended primarily for drilling, which in itself imposes a negligible radial load on the shaft bearings.

It will be seen that a plain bearing is used to take the end-thrust; in practice, this has been found quite satisfactory in view of the relatively light loading normally used.

In this connection, a thrust ring, $\frac{1}{8}$ in. thick, composed of Tufnol will form a durable bearing, and there is then no danger of scoring the thrust surfaces as a result of under-lubrication.

The end-float of the spindle in its bearings is taken up by means of the adjustable, split clamp-collar (*H*), which is set to bear against the end of the sleeve and is then secured in place by tightening its clamping-screw.

The driven end of the spindle is shouldered and fitted with a Woodruff key to take the driving pulley (*G*) which is retained in place by the clamp-nut (*E*).

As it is essential that the drills or cutters used should run truly, and to avoid undue overhang, split collet-chucks are fitted; these are closed to grip the tools by means of an internally coned

**Continued from page* 225, "*M.E.*," *February* 24, 1949.

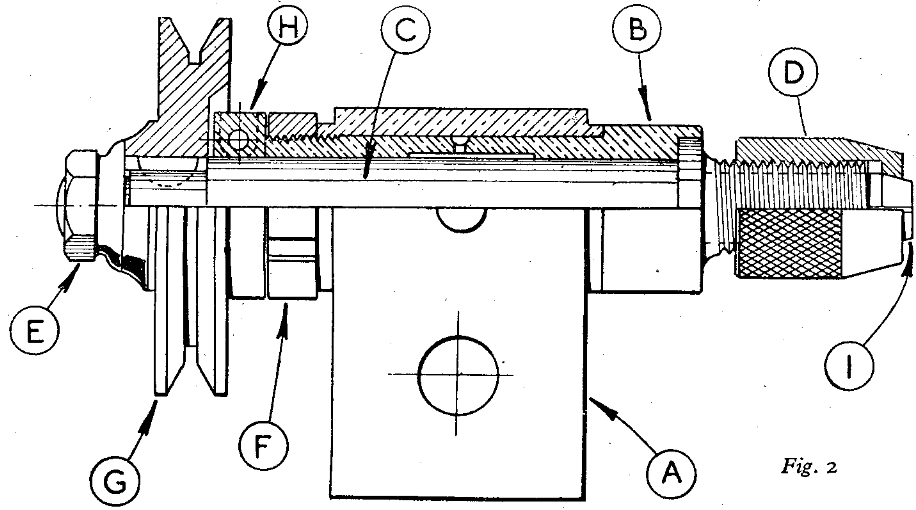


Fig. 2

cap, screwed on to the end of the spindle and tightened by finger pressure. A set of these collets will, of course, be necessary for gripping the shanks of the various sizes of drills and other forms of tools used, and in the present instance the spindle has been designed to take collets with a maximum holding capacity of $\frac{1}{4}$ in. As a rule, the spindle will generally be used for drilling holes of moderate depth, and, for this purpose, specially short drills will not only be found more convenient, but they are also stiffer and much less liable to wander. These stub drills, as they are termed, are obtainable commercially in fractional inch sizes rising in steps of 1/64 in.

The $\frac{1}{8}$-in. diameter drills used are $1\frac{1}{2}$ in. in length and have a flute length of $\frac{3}{4}$ in.

Small centre-drills are also of rigid construction and will be found useful for drilling division plates or for forming guide centres for larger drills. The commercial drills of this type have bodies of $\frac{1}{8}$ in. to $\frac{3}{16}$ in. and $\frac{1}{4}$ in. diameter with a drilling point of 3/64 in. to $\frac{1}{16}$ in. and 3/32 in. diameter respectively. For use in collet chucks these British sizes of small centre-drills will be found more convenient than their American counterparts, which in some instances have bodies either of decimal inch size or designated in sixty-fourths of an inch.

Construction

The Turret (*A*). The casting is gripped in the four-jaw chuck and all its surfaces, except the lower which bears the register, are faced to bring it to the approximate dimensions shown in the working drawings in Fig. 3. The bosses on the side faces, against which the sleeve abuts, are turned to their finished diameter at a later stage when the remaining portions of the side surfaces are also turned. The turret is next placed on the surface plate and the two cross centre-lines of the hole to afford passage for the central clamping-bolt are marked-out with the surface gauge. The point of intersection of these centre-lines is drilled with a centre drill, and the casting is again gripped in the four-jaw chuck with this centre set to run truly by employing the wobbler The clamp-bolt hole is now drilled $\frac{3}{8}$ in. and finally bored out to 13/32 in. diameter.

At this setting, also, the lower surface of the casting is faced and the register spigot is turned to fit the recess in the tool-post base.

The next step is to fit the register-pin to the turret by the method described for carrying out this operation when making the special turret to hold the commercial form of parting tool;

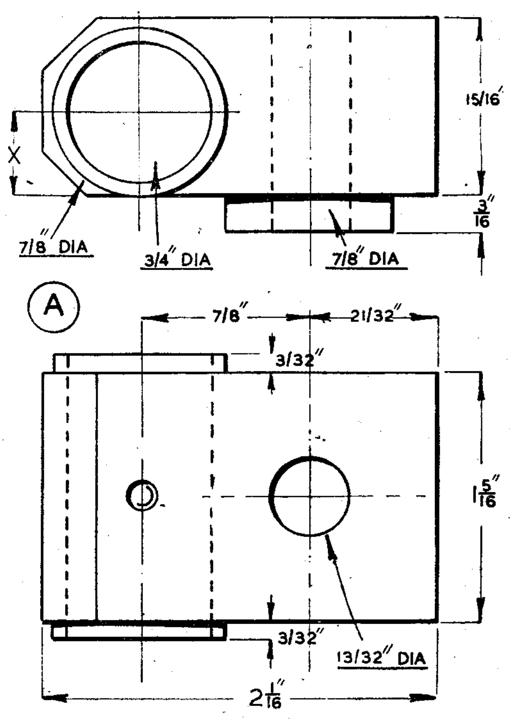


Fig. 3

briefly, this consists in drilling the base casting with a No. 31 drill to continue the register-pin hole right through to its lower surface, and then drilling back from this hole into the turret when clamped in position on the base ; the turret is then removed and reamed from below to allow the register-pin to be fitted.

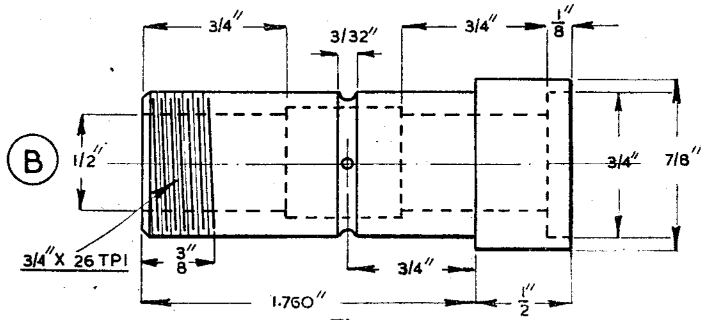


Fig. 4

When the register-pin has been fitted, the turret is clamped in place on the tool-post base and the assembly is bolted in position on the cross-slide ; a scriber or pointed rod held in the lathe chuck is then employed to mark a line at the lathe centre-height across the face of the casting. The cross centre-line of the bore to receive the spindle sleeve is marked-out from the clamping-bolt centre-line in accordance with the drawing, and this hole is then drilled to, say, ½ in. diameter in the drilling machine. Next, the turret is again securely clamped in place on its base casting, and a boring bar mounted between the lathe centres is used to enlarge the bore to its finished size.

This method of machining the turret ensures that the drilling spindle will always line up correctly, that is to say it will be parallel with the lathe axis and exactly at centre-height.

The casting is now mounted by this bore on a stub mandrel, turned to size while gripped in the chuck, and the bosses are faced and turned to their finished diameter concentric with the bore ; at the same setting the remaining portions of the side faces of the turret are also finish turned.

The two flats on the front face of the casting can be formed either by filing or by a machining operation ; for the latter, the turret is gripped at the correct angle in the machine vice attached to the vertical slide, and the machining is carried out with a milling cutter or with a simple form of fly-cutter.

To complete the machining of the casting, the hole to receive the cycle-type lubricator is drilled on the centre-line of the sleeve and then tapped with the appropriate thread.

The Spindle Sleeve (*B*). This part is best made from a length of centrifugally cast-iron bar, which is a commercial product and has excellent wearing qualities even when used for the bearings

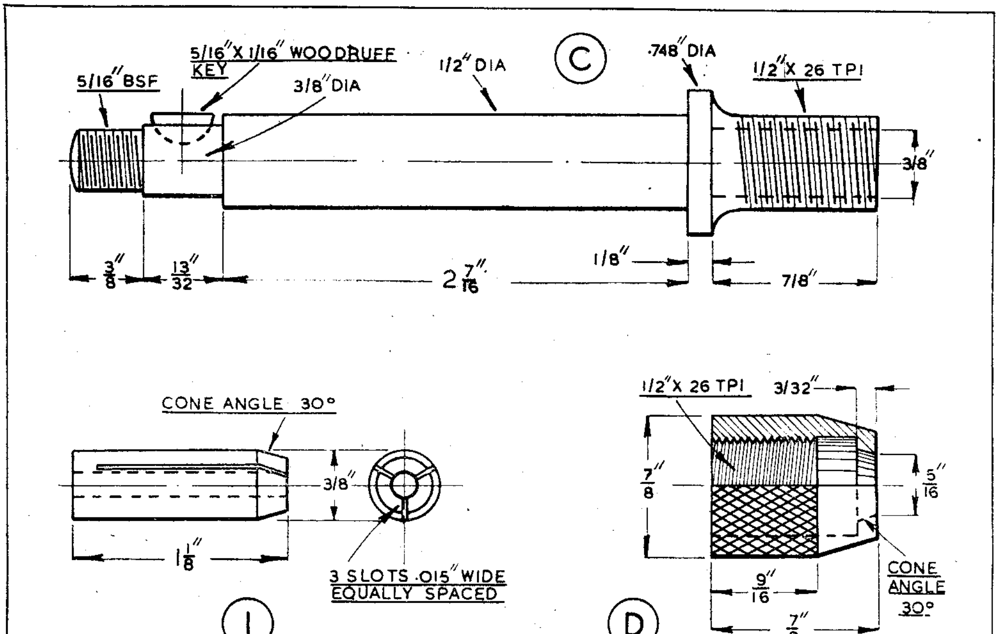


Fig. 5

of a shaft running at high speed. A piece of material some 3¼ in. in length is cut off and then mounted in the four-jaw chuck with enough projecting to allow for the machining the whole length of the sleeve. The end of the bar is faced and centre-drilled so that it can be supported by the tailstock centre.

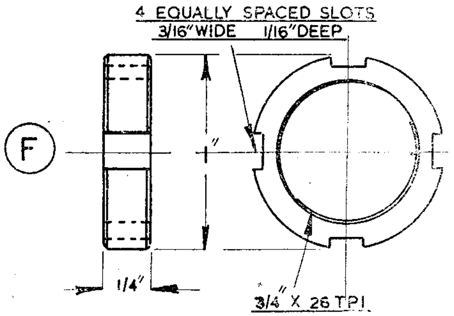


Fig. 6

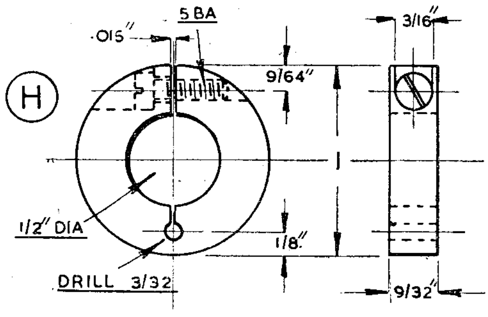


Fig. 7

The bar is then turned all over to the dimensions given in the working drawings in Fig. 4, and the oil groove is also machined at this stage. The ¾-in. diameter nose may, as shown, be screw cut 26 threads per inch, but if, instead, a thread of 24 to the inch is machined, the operation is somewhat simplified, as the leadscrew-nut can then be engaged at any point on a leadscrew of the usual pitch of ⅛ in., that is to say 8 t.p.i.; the reason being, of course, that 24 is a multiple of eight and the same applies when cutting threads of 8 : 16 : 32, to the inch.

The next operation is to part off the sleeve, allowing a small amount for facing the end at a later stage; the work is then reversed in the chuck and set to run truly with the aid of the dial test indicator. The part is next drilled right through and bored to ½ in. diameter, less one thousandth of an inch to allow for the subsequent lapping operation. At the same setting, the large end is faced and then bored 0.750 in. for a depth of ⅛ in. to accommodate the thrust collar on the spindle, but if a thrust washer is to be fitted, the depth of the recess must be increased accordingly. When the four radial oil holes have been drilled, the bore is lapped to remove all tool marks and also to bring it to the finished size. Finally, the sleeve is again mounted in the chuck to run truly and a boring tool is employed to chamber the bore to a depth of some 20 thousandths of an inch for approximately the middle third of its length. This is done to assist in the lubrication of the bearings and also to counter any tipping action that may arise when the spindle is subjected to side-thrust.

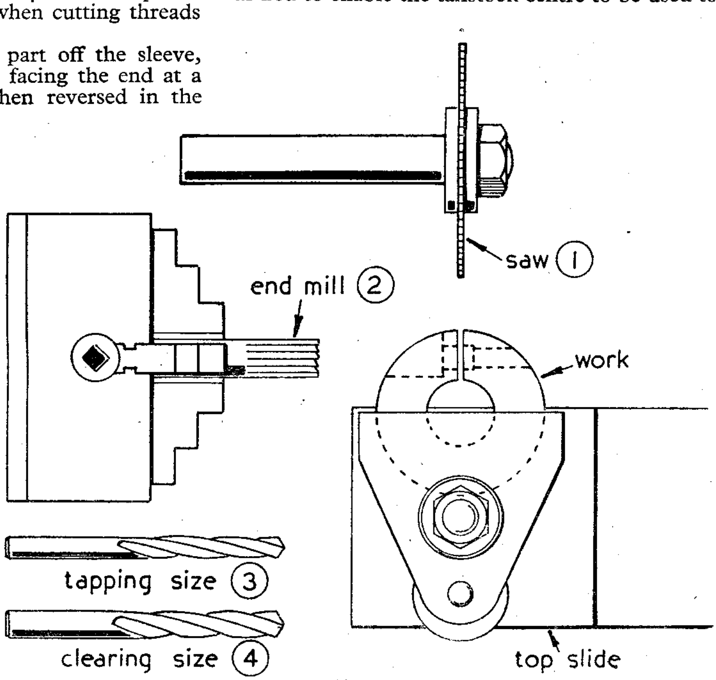


Fig. 8

The Spindle (*C*). Although the amount of work entailed in machining a spindle of this sort depends but little on the quality of the material, much may be gained by selecting a steel with good wearing properties. Nickel chrome steel is excellent for this purpose and it can usually be obtained from the car breaker in the form of a discarded side shaft from a back axle.

The piece of material selected is gripped in the four-jaw chuck and its end is faced and centre-drilled to enable the tailstock centre to be used to support the work during the subsequent machining operations.

Reference to the working drawing in Fig. 5 will show that the end is turned to $\frac{5}{16}$ in. diameter to enable it to be screw cut, or threaded with a die, to $\frac{5}{16}$ in. B.S.F. to receive the pulley-nut. The pulley seating is turned to size and the bearing portion of the shaft is reduced to $\frac{1}{2}$ in. diameter, plus one thousandth of an inch, or a little less to allow for lapping to size; at the same time, the shaft where it meets the thrust shoulder should be undercut some five thousandths of an inch to facilitate the lapping operation.

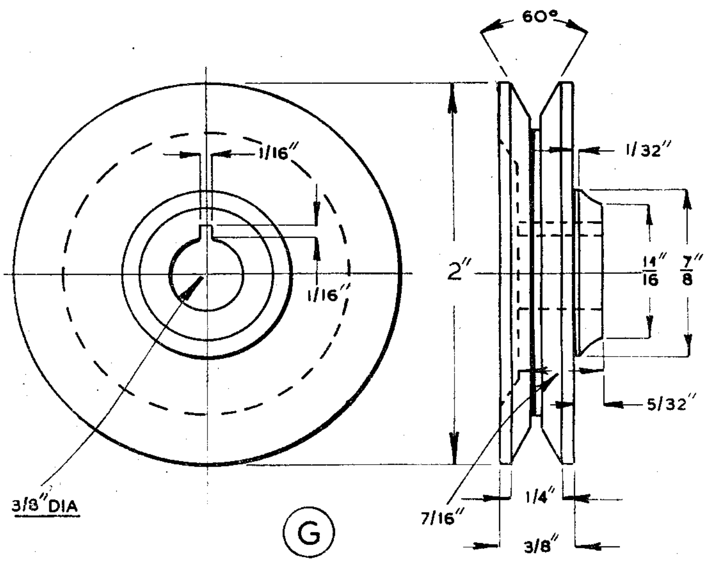


Fig. 9

The collar is next turned to its finished size and its thrust surface is carefully faced to a good finish. The spindle is then parted off and, when reversed, is set to run truly in the four-jaw chuck with the aid of the test indicator applied to the thrust collar. The spindle nose is next faced and screw cut $\frac{1}{2}$ in. × 26 t.p.i. or to any other fine-pitch thread that may be preferred; the nose is then bored to a diameter of exactly 0.375 in. The spindle is removed from the chuck and gripped in the machine vice attached to the vertical slide to enable the key seat to be milled in the lathe with a Woodruff cutter, thus completing the machining of the part.

The Chuck (*D*). This component is turned from a length of mild-steel rod gripped in the self-centring or four-jaw chuck.

The outside diameter is first turned to size and then knurled; next, the part is drilled and then bored to 29/64 in. diameter preparatory to being internally screw cut to match the thread on the spindle nose. As will be seen in the working drawing in Fig. 5, the bore is recessed at its further end to the overall diameter of the screw thread in order to facilitate the screw-cutting operation: in addition, a $\frac{1}{4}$-in. diameter drill is used to form the bore for the full length of the chuck. The chuck is then parted off slightly longer than is shown in the drawing to allow for the subsequent facing operation.

To finish the coned end of the chuck, it is mounted either on a specially made threaded stub-mandrel or on the spindle itself.

When the latter method of mounting the chuck is adopted, the spindle is set in the four-jaw chuck to run dead true and, at the same time, its surface is protected with a layer of stout paper to prevent damage from the pressure of the chuck jaws. To hold the small chuck clear of the end of the spindle so as to allow room for machining, a turned collar is interposed between the thrust collar and the back face of the chuck mounted on the spindle nose.

When the chuck has been set up in this way, the outer coned surface is turned to shape, and a small boring tool is used to form the internal cone which will engage the coned end of the collet lying within. As the chuck body is subjected to wear, it should be case-hardened before use.

Collets (*E*). As these collets are used to hold drills and it is, therefore, essential that the bore should be concentric with the outer diameter, they are best made in the manner previously described for machining the sleeve of the boring bar and the adapters used in the boring attachment type of turret; that is to say, the bore is first drilled and reamed to size and the outside diameter and the coned nose are then finish turned with the collet mounted between centres.

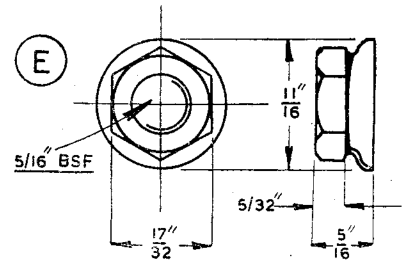


Fig. 10

To allow the collet, when in use, to close on the shank of the drill, it is cross-cut, as shown in the drawing, with either three or four slits. These three slits can be machined by a milling operation while the part is mounted in the lathe, but as an easier alternative, the four slits, or two cross-cuts, are made with a fine hacksaw, while the collet is held in the vice after inserting a piece of well-fitting rod in the bore to prevent distortion.

If, as is generally the case, steel collets are used, they should preferably be case-hardened to resist wear.

The Locking Collar (*F*). This collar, which is shown in Fig. 6, serves to clamp the sleeve (*B*) in place in the turret.

clearing size with a No. 30 drill to a little beyond the line of the collar's diameter. The radial slot is then cut with a slitting saw mounted on an arbor between the lathe centres. To complete the machining, a 3/32 in. diameter hole is drilled opposite to the slit, as shown in the drawing, and the slit is continued from the bore to meet this hole by using a fine hacksaw.

If the collar has been made a good fit on the spindle, very little pressure on the 5-B.A. clamp-

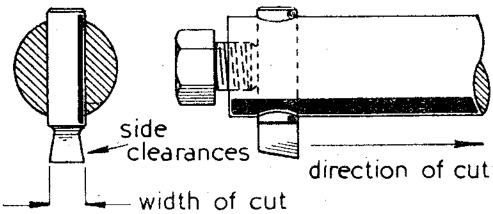


Fig. 11

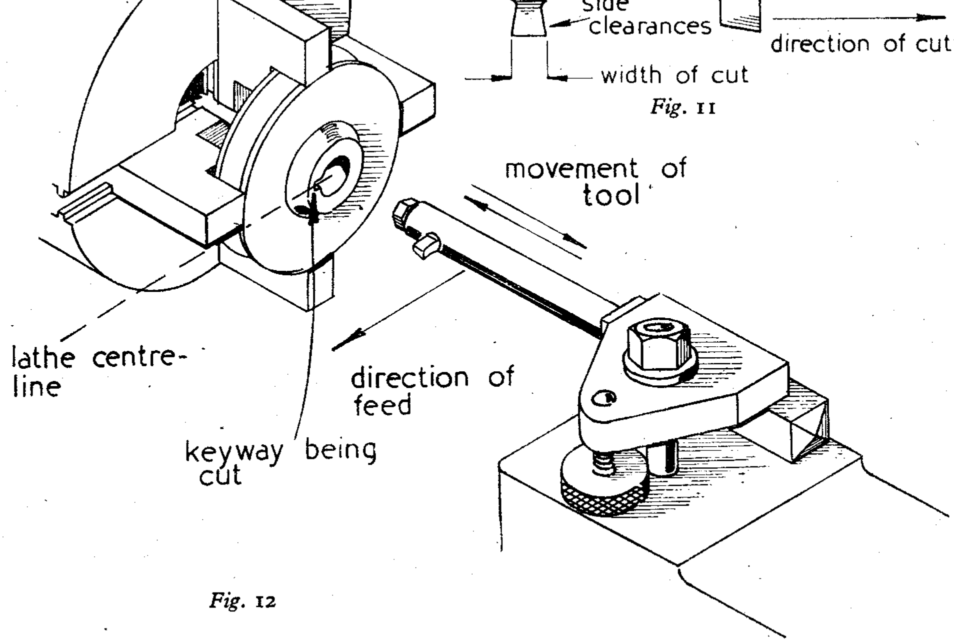


Fig. 12

After it has been turned to size, screw cut, and then parted off, the slots to afford a hold for a C-spanner can be either milled or filed to shape. The thickness of this collar should be such that on assembly it is clear of the end of the sleeve (*B*) against which the thrust collar (*H*) bears.

The Adjusting Collar (*H*). As will be clear from the drawings, this thrust collar fits directly on the spindle, and makes contact with the end of the spindle sleeve in order to eliminate end-float and to resist any back-thrust that may arise whilst the attachment is in operation. The working drawings of this part are given in Fig. 7, and it is first turned and then bored to size to make it a good push fit on the spindle.

The subsequent machining operations are illustrated in Fig. 8, where it will be seen that, after the part has been securely clamped in the lathe tool-post, an end-mill is employed to form the recess for the head of the clamp-screw; this is followed by a No. 38 tapping size drill, and the hole so formed is opened out to the full

screw will be required to afford the collar a secure hold.

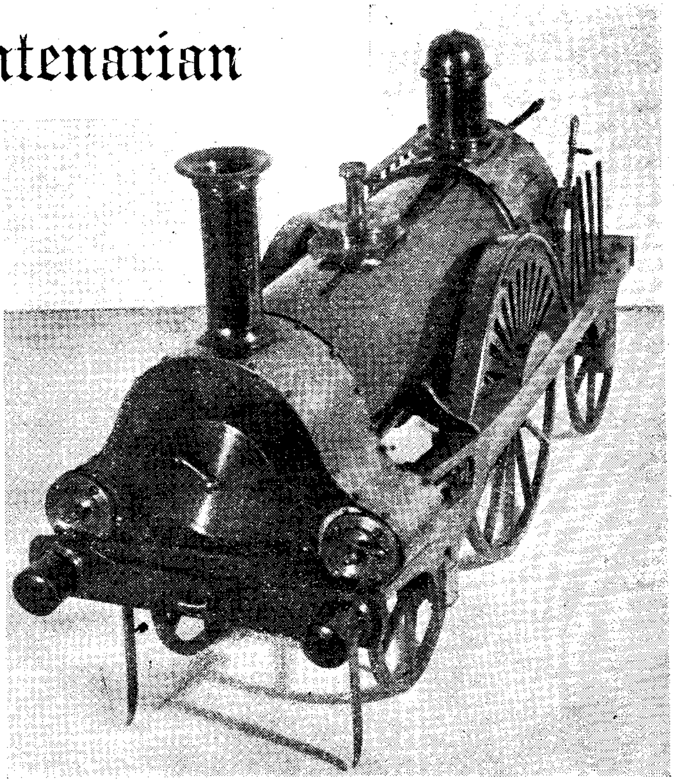
The Pulley (*G*). To ensure good wearing qualities, the pulley is best made of cast-iron, but brass or even aluminium alloy may serve for moderate use. The pulley is fitted to the spindle with a standard Woodruff key and is secured in place with a nut (*E*).

The nut shown in the drawing in Fig. 10 gives a good appearance to the work and does not require the customary washer, but if preferred, a standard nut and washer can be used. The nut shown is first turned to shape and threaded, and the hexagon head is then formed either by a milling operation or by employing the lathe filing-rest.

The keyway in the pulley can be formed by filing, in which case time will be saved if the bulk of the metal is removed by making a preparatory drill hole on the line of the key but rather less in diameter than the finished size of the slot.

(*Continued on page* 301)

A Centenarian


Bridge-view of the front end

FOR some little while there has been on view, in the street window of our office building in Great Queen Street, the remarkable old model locomotive depicted in the photographs reproduced herewith. The model belongs to Dr. John Bunyan, of Seymour Street, who acquired it after it had been "rescued" from the somewhat heavy-handed treatment of some children whose plaything it was.

Unfortunately, nothing whatever is known of its history, except that the old engine seems to have lain hidden among a mass of impedimenta in somebody's boxroom for many years. It appears to have been neglected and forgotten until it was unearthed and handed over as a plaything to the aforesaid children!

When it was eventually brought to Dr. Bunyan's notice, he quickly realised that here was something of much greater interest than might, at first, be supposed. The workmanship put into the orginal construction must obviously have been of a very high quality. Close examination of all the details fully confirms this view; also, we have made the following deductions which we pass on to our readers for consideration, since we hardly dare hope that anybody will now be able to identify the model definitely enough to be able to give its history.

First, we have not the slightest doubt that the model is very old; it is almost certainly contemporaneous with its prototype, the Alexander Allan "Crewe"-type 2-2-2 passenger engines for the London and North Western Northern Division, and built in the late 1840s. There can be no question but that these engines were the source from which the builder of the model drew his inspiration.

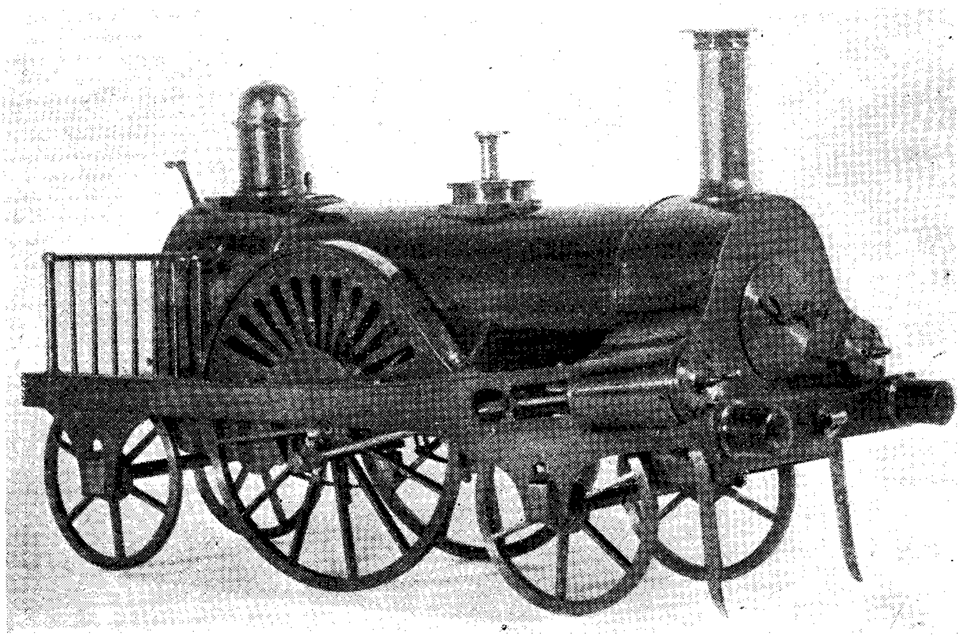
The next point cannot be so easily disposed of, because it raises a number of seemingly unanswerable questions. Examination of the photographs will show that, externally, the boiler, together with what are now left of its mountings, the splashers and the frames are quite nicely to scale and in good proportion. The wheels, however, are anything but this; moreover, they are devoid of flanges and badly deficient with regard to the numbers of spokes. Yet they appear to have been beautifully fashioned out of solid brass plate. What is the explanation of this? Why should the builder have made a really accurate representation of the boiler, etc., and then have gone hopelessly astray with the wheels? The rather obvious suggestion that the wheels were made by a different person does not appear to be conclusive because the workmanship and finish in the wheels, despite the defects, are the same as in the other parts.

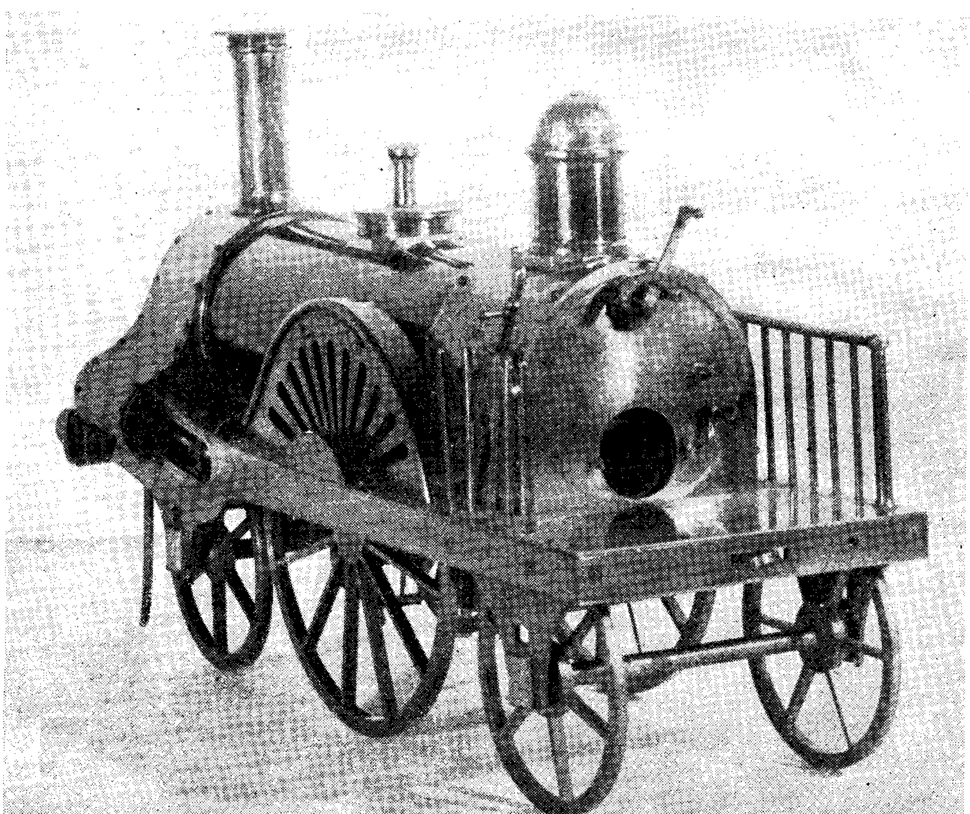
Incidentally, almost the entire model is made of brass, finished bright and lacquered; the exceptions to this are the two beautifully-made sets of Stephenson valve-gear, which are of steel. The driving-axleboxes are sprung by underhung springs, each of which consists of one leaf of flat clock-spring!

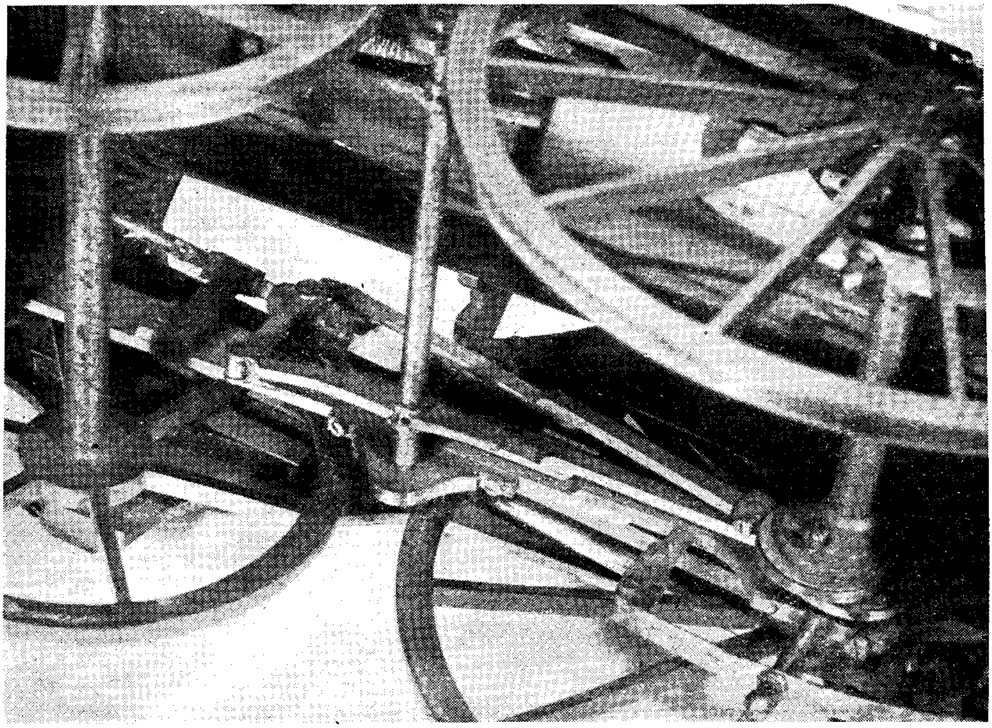
The boiler is a complete mystery, and, so far, there is no clue to its arrangement. It is covered with a single sheet of oxidised brass; the raised firebox is similarly covered, while the smokebox wrapper-plate is one continuous sheet from the underside of one cylinder, round the contour of the smokebox to the underside of the other cylinder.

Inside the smokebox, there is no sign of any flue-tubes; there is a kind of header, presumably housing the regulator valve, from which steam-pipes lead down to the steamchests. But there are no exhaust-pipes, the only provision for exhaust being a hole in the middle of the upper outside face of each steamchest.

Inside the firehole door, a small tunnel, about $\frac{1}{4}$ in. in diameter, begins and extends some way







View showing the Stephenson link-motion, driving-axle springs and the fact that the wheels are cut out of plate

into the boiler barrel, where it comes to an abrupt end. Just what this may signify has, so far, escaped us.

The gauge of the model is $2\frac{5}{8}$ in., from which, of course, the scale is $\frac{9}{16}$ in. to the foot. To this scale, the general proportions of the model and its details are reasonably correct; the driving and carrying wheels, however, come out at about 4 ft. 6 in. and 7 ft. 6 in. diameter, respectively, which is not correct.

The cylinders are provided with drain-cocks, one in the centre of each front cover, which is not in accordance with generally-accepted locomotive practice.

The model has nicely-engraved nameplates bearing the name, *Witch*, and this is another pointer to the old Allan singles.

This is about all that can be said of the model for the present, except that it is a most attractive, fascinating and mystifying antique.

Is it possible that the constructor started out to make a working model, changed his mind and decided to finish it as a "glass-case" exhibit? And does anyone know of another like it?

In the Workshop

(*Continued from page* 298)

On the other hand, the keyway can be accurately and quickly cut by a simple machining operation in the lathe.

For this purpose, a square-ended tool-bit of the same width as the keyway is mounted in a small boring-bar as shown in Fig. 11, and the bar is then secured in the lathe tool-post at centre-height and with the cutting edge of the tool facing towards the tailstock.

The pulley is mounted in the lathe chuck and the mandrel is then locked. The keyway is cut, as represented in Fig. 12, by using either the saddle rack gear or the leadscrew feed to move the cutter to and fro while the tool is fed outwards from the centre by means of the cross-slide feed.

When carrying out this machining operation, it is advisable to pull and not push the tool while cutting and, in addition, only light cuts should be taken to avoid springing the tool.

The Model Power Boat Association

AT the annual general meeting, held on January 29th, at the Central Club, London, E.C.1, the following decisions were made :—

New Competition Rules for Racing Boats

(1) *Silencers.* The recent decision of the committee that silencers shall be used on all racing boats in competition was ratified by the meeting and a rider added that clubs should encourage their members to use them at all times where possible, besides regattas.

(2) *Height of Line.* The height of the line at the tripod shall be 15 in. above the level of the water for the standard 100-yd. lap. For laps of greater or less than 100 yd., a proportionate height should be taken.

(3) *Classification of Racing Boats with Commercial Engines.* It was decided that racing boats fitted with commercial engines (i.e. an engine bought complete, or as a machined kit of parts) should be classified separately.

Thus, in future, 10 c.c. boats of this type of engine will be known as "Class C (restricted). There will be a M.P.B.A. trophy for competition.

Regatta Fixtures

Apr. 24	Kent.	June 26	Malden.
May 15	S.E. Association.	July 10	Derby (C Class).
May 22	Victoria.		
June 6	Bournville.	Aug. 14	Guildford.
June 12	Altrincham.	Aug. 28	Grand.
June 18	Coventry.	Sept. 11	Blackheath.

The following officers were elected : *President,* E. W. Vanner. *Vice-Presidents,* F. J. Pierson, J. Crebbin, F. Bontor. *Chairman,* E. T. Westbury. *Hon. Secretary,* J. H. Benson. *Hon. Assistant Secretary,* A. Rayman. *Auditors,* L. Pinder, R. Cluse.

Clubs are asked to nominate their representative for the committee, especially those in the London area.

The committee are to consider whether in nomination races boats should be allowed a "fend-off," should they run, of course. There is no rule on this matter at the moment.

Life membership of the Association was introduced, and by a unanimous vote M. Suzor, of Paris, was nominated. The committee are considering further possible nominations.

PRACTICAL LETTERS

Soft-soldering

DEAR SIR,—*Re* soft-soldering by Mr. J. W. Tomlinson in THE MODEL ENGINEER, January 6th issue, the nipple shown ready for soldering to pipe in Fig. 9 should not be soldered to the pipe and is not designed for that purpose either. The cone shown belongs to a copper tube coupling where a friction joint is all that is made, to hold in some cases, very high pressure.

Many of the present-day machines operated by hydraulic systems use this type of coupling on their brass and copper tubes, the same sort or similar were used in the early days of the last war on light solid-drawn galvanised tubes for housing schemes and factories with, I believe, very satisfactory results.

Several people I know, unaware of the proper use of this type of coupling have soldered the cones to the pipe, and I have been instructed to do so on several occasions. There is no need to solder the cone to the pipe, if fitted properly it will hold several hundred pounds pressure without giving the slightest trouble. I find myself at variance with J.W.T. on the use of cored solder for all and sundry joints, while freely admitting that cored solder has its uses, it would not appear to me to be the sort of solder to have by one for any and all jobs that come along, and which, say, the average handy-man may be called upon to do.

I do think he has overdone the recommendation of the solder in question.

He possibly gets good results, especially on small articles, such as electrical connections and similar joints. But from my own experience it would seem that anything very much larger must be pre-tinned, when, of course, any ordinary solder and, say, Baker's fluid would make an ideal job with the advantage that all surplus flux can be washed off with preferably hot water when this type of flux is used. Cored solder does seem to be rather messy on the larger surfaces, also oxidisation appears to beat the flux which is in the cored solder, the heat spreads over the piece of metal much faster than the flux, and, therefore, this type of solder does not seem to be suitable for all and sundry jobs.

Having tried on numerous occasions to tin different jobs with cored solder I have long since given up trying, for, excepting very small joints where a flash of solder is all that is necessary, I have never yet been successful on anything other than the very small jobs.

Furthermore, knowing that excellent work can be done with the more conventional flux and solder, I am going to stick to that until something better comes along. I have no wish to condemn the cored solder, as I have already said it has its uses, but I don't think it should be recommended to the model engineer as being the answer to any and every soldering job which he may have to do, more especially as it has to be borne in mind that many of "The Fraternity" are absolute amateurs, who would probably give up in disgust, blaming everything and not knowing rightly who or what to blame.

For my own use I always keep a supply of $\frac{1}{16}$-in. solid solder wire and rarely use anything else other than Baker's fluid, although I have used a liquid acid flux supplied by Fry's Metal Foundries which I like even better than Baker's, but the firm for whom I work, almost invariably stock the last-named, and for them I am called upon to carry out all sorts of soldering work.

I would like here to clarify the early part of this letter where reference is made to the use of copper tube couplings on galvanised pipe during the last war, this was due to copper tube being unobtainable; the couplings and copper tube had, of course, been used for many years before on all types of building work together with a variety of other work, such as, for instance, on ships.

In conclusion, it would be better to keep the liquid flux handy, and to dip the hot iron into it immediately before use; it keeps a better tinned face which rarely wants filing, and will do a better job than if the face of the iron is only wiped across a damp cloth.

I agree with many of J.W.T.'s points; the foregoing are simply my views based on my own experience, and I have no desire to belittle his efforts—on the contrary, I have every desire to be helpful.

Yours faithfully,

Poole. D. NICHOLSON.

Metric Measurements

DEAR SIR,—I agree with Mr. Whiteley's opening remarks concerning the metric measurements recently given for a model diesel engine; I, too, find it annoying to make so many conversions.

I do not, however, agree with Mr. Whiteley about the "limits." How many times have models been built up to the last detail or so, when it has been discovered that a "pick-up" hole is 0.05 in. "out" through accumulative error? By "tying up" vital dimensions, this risk can be nearly eliminated.

To carry my "war" a little further, why do "L.B.S.C.", Mr. Westbury and others still stick to the old-fashioned sixteenths, sixty-fourths, etc.? We speak of odd "thous," so why not go the whole way and dimension everything in decimals? Even "three-quarters" sounds awkward when compared with "point seven-five." It is also less confusing, and clearer, when working off drawings. We often hear the expression "near enough three-sixteenths," but when using the decimal 0.187 even if we only have a rule, we shall at least strive to get the odd 0.007, thereby being more accurate than usual.

Yours faithfully,

Kingstanley. K. B. MACAULEY.

DEAR SIR,—With reference to Allan Whiteley's letter on the metric system in the February 10th issue, I would make the following comments:

To the model engineer, the metric system is no deterrent, it's just part of the job, and conversion, in my opinion, is very interesting.

Even if the dimensions on Mr. T. Brown's "diesel engine" were in the English system, it could not be made with only a rule for measuring.

He also mentions limits, I am afraid that in model-making, if one wants a successful model one must adhere strictly to them.

Evidently, Mr. Whiteley has a lot to learn about model engineering.

Yours faithfully,

Harrow. A. LEE.

CLUB ANNOUNCEMENTS

The Society of Model and Experimental Engineers

At the society's meeting at Caxton Hall, on February 18th, Mr. W. H. Hart delivered an extremely interesting talk on locomotive and track matters, the audience being invited to join in what proved to be a lively and very informative discussion of the points raised by Mr. Hart.

Great interest was shown in the desire expressed by many clubs and societies for a scheme to grant certificates of proficiency to locomotive drivers after a thorough examination of their capabilities. Such a measure was becoming urgently necessary in view of the steadily increasing popularity of miniature railways at public fetes. As this is a matter of such wide general interest, the hon. sec. would welcome letters from readers expressing their opinions.

On Saturday, March 19th, a Brains Trust joint affiliation meeting will be held at Caxton Hall, Westminster, at 2.30 p.m. All members of affiliated societies will be welcome.

Hon. Secretary: A. B. STORRAR, 67, Station Road, West Wickham, Kent. Springpark 3027.

The Junior Institution of Engineers

Friday, March 11th, at 6.30 p.m., 39, Victoria Street, S.W.1. Ordinary meeting. Paper, "Recent Developments in Power Plant Controls," by S. J. Clifton, M.Inst.F. (Member).

Friday, March 11th, at 7.30 p.m., Mechanics' Institute, Burton Street, Nottingham. Discussion evening.

Western Group of Members:

Friday, March 11th, at 7.30 p.m., The Technical College, Bath. Ordinary meeting. Paper, "Some Experiments with Rotary Valve Engines," by R. C. Cross, M.I.Mech.E. A.F.R.Ae.S.

Friday, March 18th, at 6.30 p.m., 39, Victoria Street, S.W.1. Informal meeting. Paper, "Structure and Organisation of the Engineering Industry," by H. J. Novy (Associate).

Ickenham and District Society of Model Engineers

Our recorded membership now stands at 56, and we continue to make healthy progress. A portable track covering $3\frac{1}{2}$-in. and 5-in. gauges is in course of construction, rails being of light alloy of Vignoles section.

Temporary workshop space has been allotted until we can use a more convenient building. We shall be holding an exhibition of members' work on May 14th, at the Village Hall, with outdoor passenger-carrying track and working set-pieces in "OO" and "O" gauges inside.

Visitors are always welcome at our meetings every Friday, at Ickenham Hall, 7.30 p.m., except March 4.

Hon. Secretary: H. C. PIGGOTT, 23A, Parkfield Road, Ickenham.

The West London Model Power Boat Club

The annual general meeting of the above club was held at the Leinster Arms, Notting Hill, on February 6th. After the prize-giving by Mr. F. H. Lambert, members heard with regret that Mr. R. Robinson, the Commodore, and Mr. G. E. Fidler, the secretary were obliged to give notice of their wish to relinquish office owing to prevailing domestic circumstances, and a vote of thanks was passed for the able services which each had rendered over the past year. In the fresh elections, Mr. R. Roberts became Commodore, and Mr. J. P. R. Bell became hon. secretary. Mr. Kidd and Mr. Butler were elected to the committee.

It was resolved that fortnightly evening meetings should be arranged for the benefit of all members, and a private room has been booked at the Leinster Arms for this purpose. It is hoped that members will extend their fullest support to this venture so that interesting lectures and discussion groups may be included in the future programme.

Hon. Secretary: J. P. R. BELL, 53, Drayton Gardens, London, S.W.10.