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BENDING & ROLLING METAL

There's an art to forming sheet metal. You can simply clamp it in the vice and hit with a hammer but this chapter shows how it should be done

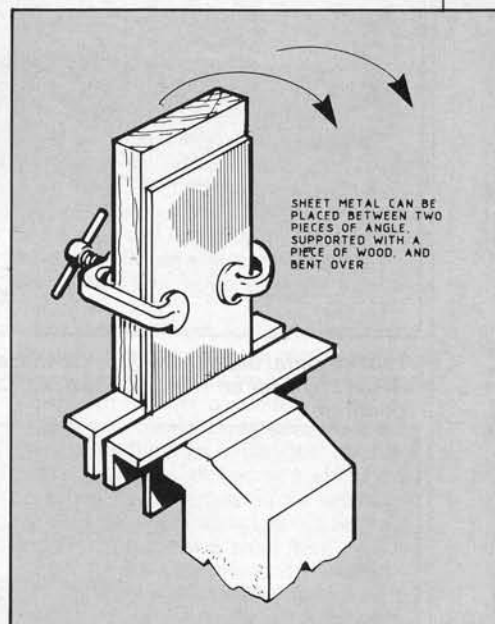
No matter what form our model engineering takes, from time to time there will be a need to bend or roll metal for various reasons. Of course we can just get our piece of metal, put it in a vice and hammer it to a right-angle and then cut it to the required length on each leg. Providing that suits the purpose there is certainly nothing wrong with the method. Blacksmiths for years have been doing just that and some have turned out very fine work. Normally, of course, they work with black iron which is quite ductile and it is heated and worked while hot which makes life fairly simple. Curved surfaces would be formed by eye over the peak of the anvil and a series of attachments which went into a recess in the other end of the angle facilitated forming many other shapes.

These methods have largely gone out of practice these days and most metal is now bent while cold. The model engineer is

likely to want something a little more sophisticated than hammering the metal to shape with no thought as to what the end result will be, and a degree of accuracy will be needed for most work. Let us then first of all concentrate on bending metal to shape and then discuss rolling it to form tubes, etc.

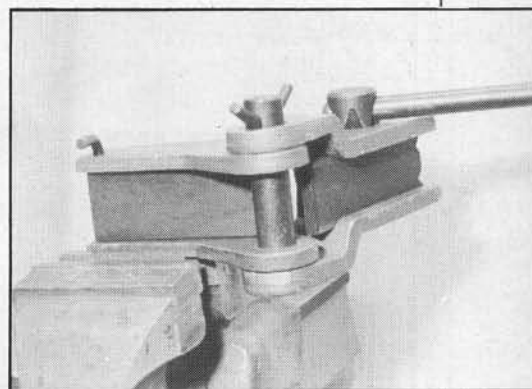
Possibly the first thing we need to know is how our particular metal is going to react to bending. This is quite a difficult one to answer as every type of metal has so many grades these days and usually we do not have the faintest idea what quality of metal we are working with. Mild steel is possibly the metal we are most likely to wish to bend and usually this will do so quite well. Black mild steel is particularly good for such operations and free cutting mild steel follows it closely.

As the steel gets harder so bending gets more difficult. Not the actual force involved

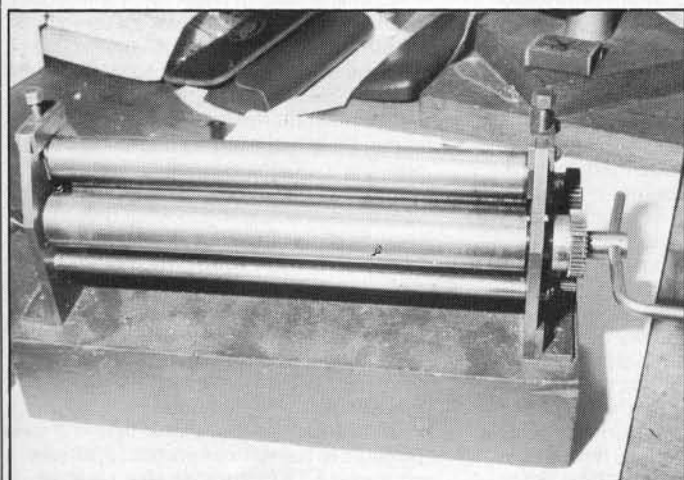


so much, although that does increase as the steel gets harder, but rather the fact that the harder steels will be inclined to crack when bent. The greater the angle the more the likelihood of cracking, and possibly breaking, occurring.

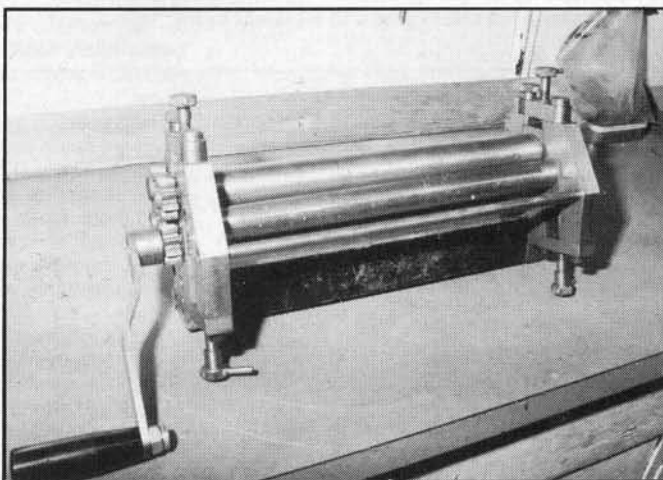
Below, the CZ general bending device is very popular. It will form radii and square edges depending on which of the supplied formers is used. Additional formers are easily made from mild steel. The bender is designed for use with strip metal rather than sheet.

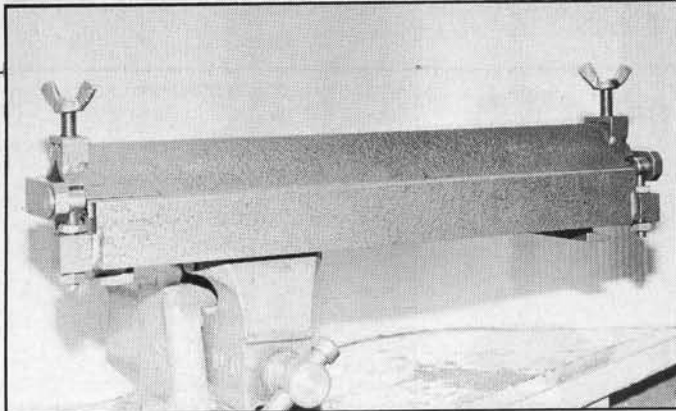


Bending rolls made by Peter Robinson; although these are to his own design, plans are available for a similar machine (plan WE9 by Martin Evans) in the Model Engineer Plans Service range.

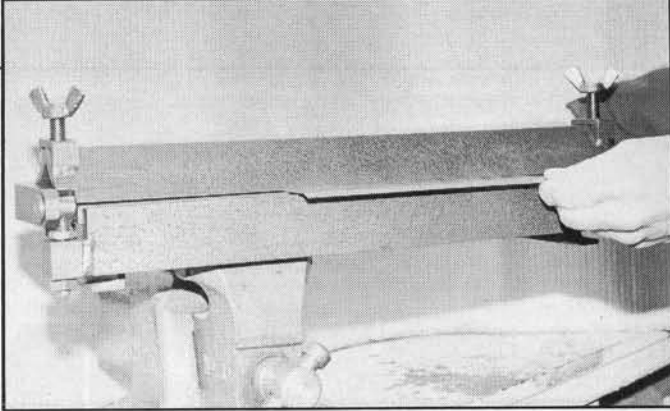


These rolls are by Charlie Ingleby, again to his own design but influenced by some described by George Thomas. Any metal of suitable strength can be used in their construction.

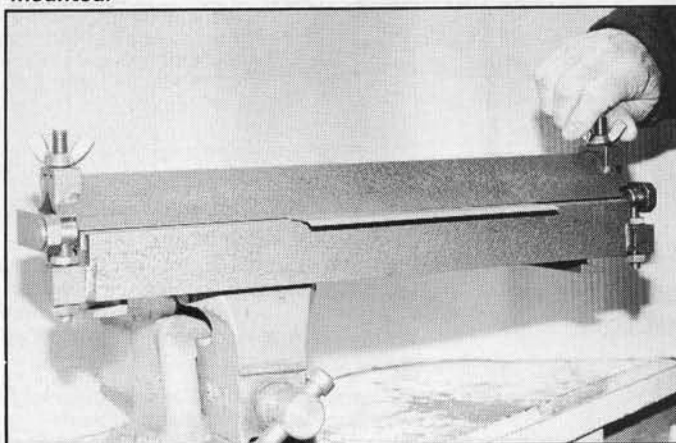




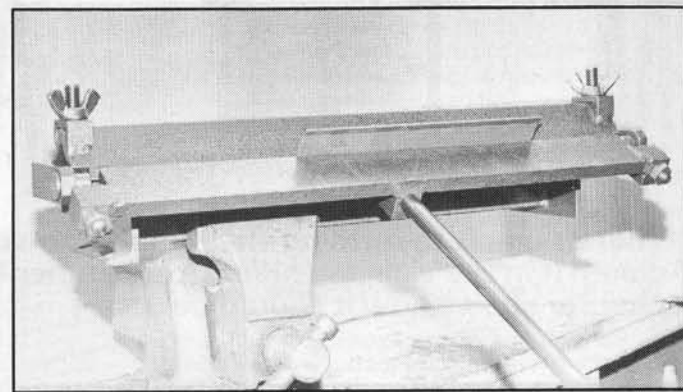
A sheet-metal bender. Designs for these have appeared in Model Engineer on several occasions. Can be bench or vice-mounted.



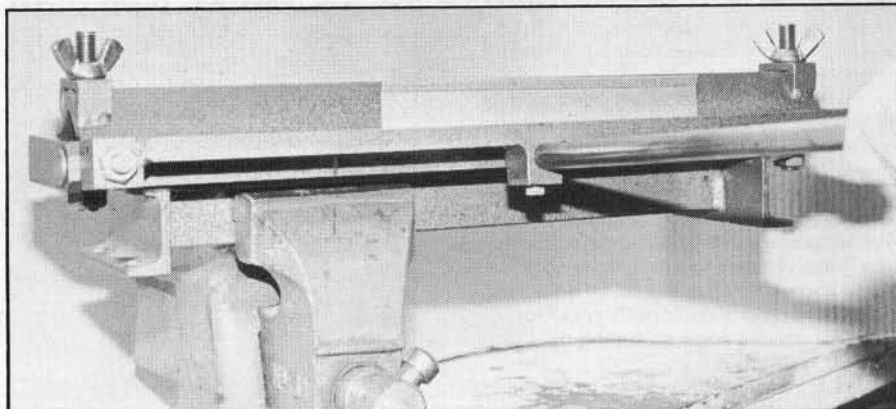
The metal should be scribed with a line at the place where the inside of the bend is required and this carefully adjusted to the edge of the top clamp of the tool. Care at this stage means the difference between getting the bend accurate ... or not!



Once the scribed line is in position, the bender is adjusted so that the pressure is equal at each end of the metal. There is also an adjustment for the thickness of the metal being used.



Bending should take place fairly slowly so that, if the metal should slip, mistakes may possibly be rectified before too much damage is done.



The work, assuming a right-angle is required, should be bent to just over ninety degrees to allow for a slight spring-back in the metal.

The best way, and this will apply to all metals, is to try a small piece first and see what happens rather than spoil a good piece of work by trying to bend an unsuitable chunk of material. Fortunately we can still take a leaf from the blacksmith's book and bend steel when it is red hot, in which case cracking is unlikely to occur.

Brass can be a problem since, like steel, there are some varieties which are soft and will bend easily. Others are hard and will break as soon as any attempt is made to bend them. Brass does not always respond well to heat treatment and any attempt to soften sheet brass will, unless a proper oven is available, result in buckling of the metal.

Copper bends very easily when soft and is easy to soften without distorting it. It can simply be made red hot and then either left to cool or, better still, quenched in cold water. It does harden up again with work so if a lot of bending is involved it could be necessary to soften it two or three times.

Phosphor bronze reacts in much the same manner.

Aluminium and its alloys are similar in their reaction to brass but most sheet aluminium bends quite easily. It is rod and bar that one needs to be a little careful with although, on the whole, it will work quite well.

Nickel silver will invariably bend well although its natural springy nature means it requires more force than other metals in order to get it to shape. This means that bending sheet to a right angle can be quite difficult and, like brass annealing, is not a viable proposition unless a proper oven is available.

Where I have suggested metals will not bend well then, for the average amateur, there is no answer to the problem and it is best not to try and bend it. If right angles have to be formed then the metals should be cut to size and joined with silver solder.

Stainless steel in sheet form will usually bend well but requires quite a degree of force. Rods and bars will also bend quite well and only exceptionally hard varieties of the material cause any problems.

So much for the metals. Now let us think about the actual bending operations. It is possible to purchase small folding machines for sheet metal and these will vary in price according to what they are capable of dealing with. There are also benders available which will deal with rod and bar section; again much depends on the price paid as to what the equipment will do but there are some very good, cheap buys for this sort of work. Use of such tools will be explained in the manufacturers' instructions.

If no such tool is available then it is quite possible to bend metal without specialist equipment. The important thing is to be

BENDING & ROLLING METAL

able to grip the edge where the bend will take place in a firm manner and to have a straight edge on each side to keep the metal in the right place. The part being bent should be levered over rather than hammered. For example, supposing we are to bend a sheet of mild steel. It will first have to be one that is not too thick to be bent without specialist equipment – up to 2mm thick should pose no problems. The sheet should be secured along the bending line by two pieces of angle. A wooden board or a thick sheet of metal should be clamped to the part projecting upwards and this is then pulled down to create the bend. The thicker the supporting wood or metal, the easier the bending will be.

Generally speaking, the force required for metal bending varies not only as one would expect, with the thickness, but also with the width. Suppose then that we have a piece of $\frac{1}{16}$ th inch or 1.5mm strip steel 1 inch or 25mm wide. That will bend without any great difficulty. If, however, we take a piece of the same thickness metal but, say, 10 inches or 250mm long, then bending it along its length will require a great deal more force even though the thickness is the same. Double the length again and even greater force will be required. The answer is, the greater the length along the bend the more the leverage that will be needed to create the bend.

Suppose now that we have the facilities – whether a machine or by hand – to bend our metal. The next thing we need to know is what total length of material we need in order to get the correct length at each end of the bend. It is quite possible simply to take a piece of metal, bend it, and then cut it to length. In fact if we are bending a narrow strip there is much to commend such a method. If sheet is being bent, or even a wide strip, then it is not quite such a good proposition. If, for instance, we have bent a piece of metal $\frac{1}{16}$ th or 1.5mm thick and 10 inches or 250mm wide and we want to cut it to two sides 2 inches or 50mm each then there is going to be a lot of cutting to be done and because of the bend the metal will be very awkward to deal with.

When bending metal, material on the outside of the bend is stretched and on the inside it is compressed. A good example of

this can often be seen when a plumber makes a tight bend in copper tube. The inside of the bend contains a number of ripples. It is not bad workmanship, it is just the tube compressing on the inside of the bend. Somewhere between these two is a line that neither stretches nor compresses. Commonsense seems to suggest that this neutral line must be along the centre of the material thickness. For example, if we bend $\frac{1}{8}$ th or 3mm metal the line should be at $\frac{1}{16}$ th or 1.5mm. Life alas, is never quite so simple as that and the optimum bend position differs slightly with each type of metal.

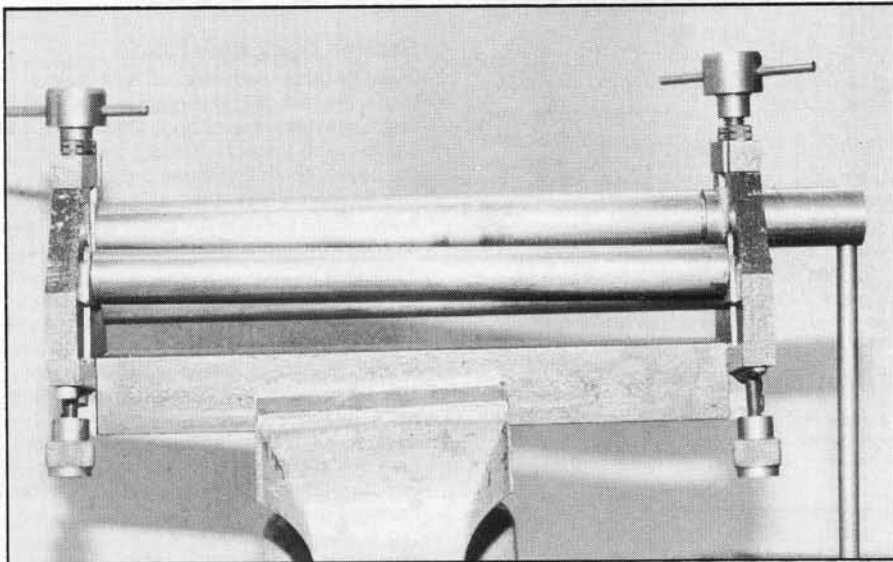
For most practical purposes we can consider it to be $\frac{1}{3}$ rd of the metal thickness and to calculate the allowance needed to allow for the bend in the metal we need to take the inside radius of the bend plus our $\frac{1}{3}$ rd. As the metal gets thicker the bending neutral line gets nearer to the centre of the metal thickness. It is as well if using metal up to, say, $\frac{1}{4}$ in. or 5mm thick to use the figure of $\frac{1}{3}$ rd and for metal thicker than that to use $\frac{1}{2}$. Whilst these are not precise they will give readers a reasonable figure to work to and, if more accuracy is needed, I would suggest reference to a high quality engineering textbook in order to find the correct calculation.

To calculate the length of metal we require we will, in the case of a sharp right-angle bend, need to use the length of each side of the bend plus $\frac{1}{3}$ rd of the thickness. In the case of a larger radius such as that of a boiler shell, we will need the inside diameter of the shell plus $\frac{1}{3}$ rd of the metal thickness.

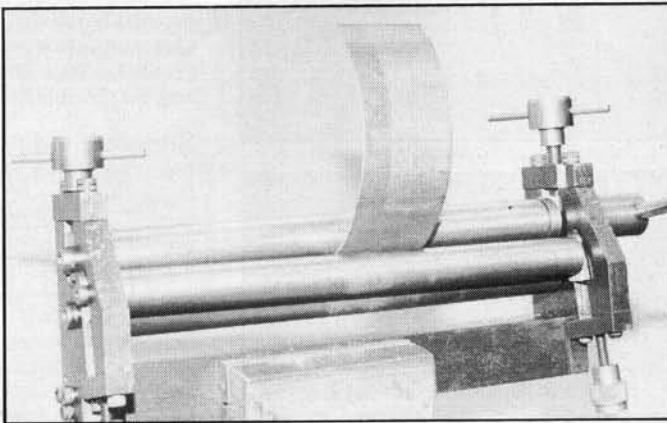
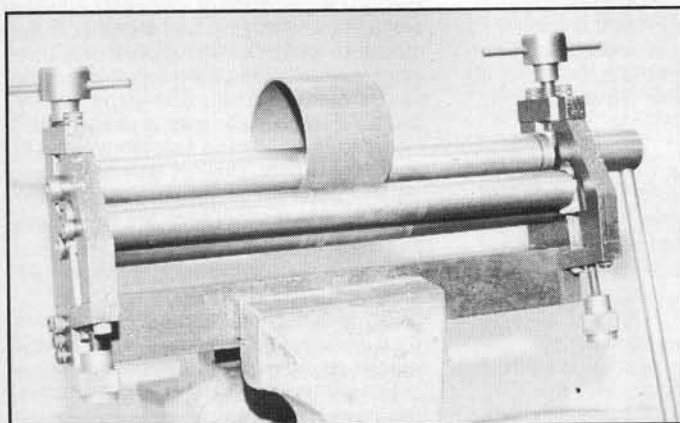
As far as rolling metal to make tubular shapes is concerned then, here again, there are metal rollers available on the market. An alternative is to use a wooden former and to form the metal round this by literally rolling it on the floor or bench. It can be pulled together with wire or a jubilee clip if one so wishes. Try to avoid the use of a hammer or similar object as this tends to stretch the metal and, apart from making nonsense of any calculations, it also can make the material uneven in length as it might spread more in some areas than others.

The formula pi is used to calculate the length of material needed when rolling operations are carried out; the measurements can be taken from either the inside or outside of the cylinder to be rolled using pi in either case.

The author's bending rolls can handle metal up to 1.4mm thick.



When using bending rolls, the first roll of the metal should be a shallow curve. This is the start of a smokebox for a model traction engine.



R A N D O M HINTS & TIPS

clamping it down, a scribe is set in the chuck the bottom of the vee can be lined up perfectly to allow cross-drilling to be carried out.

Files

Files, hack-saw blades, etc., should never be used on brass once they have been used on steel. No matter how little used, the work on brass will never be effective. Either keep two files and mark the handle of one showing whether it is for brass or steel, or when buying a new file mark each side of it with a colour code. Say red for brass and blue for steel. The file can now be used for either metal.

Securing eccentrics

Securing the eccentrics on a model steam locomotive can be quite a problem. The usual way is to use a recessed Allen headed grub screw and to tighten it up as hard as possible. Because the screws themselves are hard they will tend to dig in to the shaft and hold secure. Sometimes, though, this does not work all that well. The grub screw does not indent the shaft sufficiently to hold as well as one would like. Make up a screw with a hole through it. Use it to adjust the eccentric in the normal way. When the adjustment is correct pass a drill through the hole in the screw and make a dimple on the shaft. The screw can now be replaced with the correct grub screw, which will enter the dimple and so be prevented from moving out of position.

Removing flux after silver soldering

To remove flux after silver soldering, soak the workpiece overnight in a 50/50 mixture of vinegar and water. This will dissolve any flux residue as well as cleaning the workpiece.

Scriber sharpening

Scribers that are sharpened on a grindstone quickly lose their temper. They can be sharpened on an oilstone or on a piece of emery cloth laid on a flat surface. After sharpening, hold the scriber vertically and rub it twice across the sharpening medium. This just takes the fine point down enough to prevent the point from breaking away when in use. If the point does break away, the break is usually so fine as not to be seen with the naked eye. The minute jagged edge will, however, cause the line scribed to be less accurate than one would wish.

Protecting files

Use old garden hose or other soft tubing to protect files which are kept together in a drawer or tool box. If they rub on each other the teeth wear quickly. For larger files use the cardboard rolls from paper towels and toilet rolls. Plastic tubing can also be placed over knives and split lengthways to fit on saw blades. This not only protects the blades but also prevents cut fingers when trying to take the tool from the drawer or tool box.

Broken slot drills

If slot drills become damaged with one tooth broken, just sharpen the remaining one on an ordinary grindstone and the cutter will function very well as a small flycutter.

Extra work space

A clean workbench is always desirable but seldom convenient in the small workshop. Yet for marking out and some other jobs it is essential. A piece of chipboard, preferably one covered with a plastic such as Formica and screwed to a heavy baton of about 50x50mm timber can be kept in the workshop out of the way and placed in the vice when required to act as your clean bench.

Correcting holes

It sometimes happens that, when you start drilling a hole, the drill moves off the centre punch mark. No amount of fiddling will persuade it to assume the correct position. Drill a hole of the correct size in a spare piece of steel plate. Stick the plate on the work with the hole in the required place, using cyanoacrylic adhesive and run the drill through that when the adhesive has set. The hole will take up its correct position without any bother.

Broken hack-saw blade

If two or three teeth strip off a hack-saw blade, the rest still have plenty of use left in them. However, it is not possible to use it as it is because the jarring effect caused by the broken teeth will throw the blade off line. To solve the problem grind the blade in a very slight curve at the place where the teeth are broken and it can be used until worn out.

Drill sharpening

Sharpening drills without a jig is a problem. A gauge for the angle helps. The following little tip gives a quickly made gauge that is only one degree out. The angle should be 59 degrees. Two nuts stuck together will give two angles of sixty degrees which, whilst not dead accurate, is better than not having a guide at all!

Close shave

Drilling or tapping holes close to an angled edge can be difficult if it is not possible to get the chuck inside the angle. Drill a hole in a piece of metal rod just slightly larger than the tap or drill, and stick the tool in with a strong retaining compound such as Loctite 601. Providing care is taken it should now be possible to drill or tap as required.

Simple dividing

Dividing small round bars by two, three, six, or even twelve for milling on the vertical slide can be achieved by securing the bar in a suitable sized nut and rotating the nut to obtain the divisions.

Cross-drilling

Cross-drilling round bars can be a problem; usually some special form of jig or holder is needed. If a vee block is available that can be clamped to a drilling table then if, when

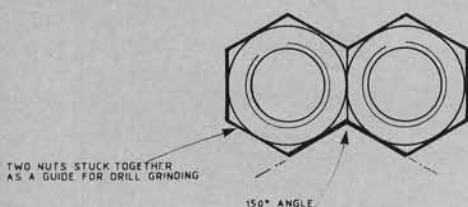
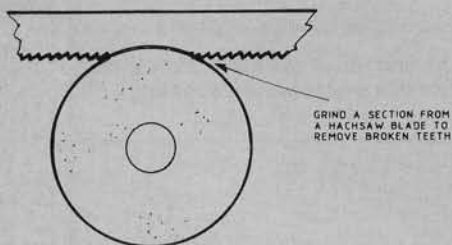
These are odd little dodges useful in the workshop. They are just a few of very many that I have picked up, mainly from other people, over the years and are in no particular sequence. I hope that readers will be able to find something amongst them which will be of use at some time or another.

Gaskets

When making gaskets for steam chests, etc., it is usual to use either brown paper soaked in oil or one of the proprietary packings. The first is difficult to use as the paper is inclined to split when oiled, the second raises the height of the components and can cause the valve rod to be out of line, or for there to be too much lift on a slide valve, which means adjustments need to be made. Aluminium foil as sold in kitchen rolls will obviate both of these faults. It is easily cut with a craft knife, and holes can be pierced with a small centre punch or scriber allowing the bolts or studs to enlarge them to the right size. When tightened down the foil is completely steam-tight and is not affected by water, steam or oil.

Broken drills and taps

If a drill or tap is broken in a piece of brass or copper it can be removed by soaking in a solution of Alum in water. The broken tool will, in a period of time, completely dissolve without affecting the brass or copper. Alum is also an excellent medium for cleaning copper when boiler-making. The fumes given off, however, greatly affect steel or iron components in the vicinity. It should not therefore be kept in the workshop or garage unless in a sealed container.



Chatter

If trouble is experienced with chatter when turning on the lathe this can often be cured by inserting a piece of cartridge paper under the tool and then tightening it down. The paper gives sufficient flexibility to the tool to enable it to move with the work but it will not bounce and so chatter will be prevented.

Washing-up liquid

Washing-up liquid can be most useful. It is very good as a cutting lubricant for copper or aluminium and similar alloys but can, in an emergency, be used as a cutting liquid for mild steel as well. It also makes an excellent threading lubricant. It must be used neat and, apart from when cutting threads, should be used sparingly. It can be used for running-in mating parts and is particularly good on slide valves. When carbon steel is to be hardened if it is first coated with washing-up liquid and then heated to the required temperature the normal, hard-to-remove discolouration does not take place and the steel can be returned to its bright colour very easily. A little of the liquid rubbed on the teeth of a file before use will prevent the teeth from clogging. The containers, or squeeze bottles as they are commonly known, make very good applicators for cutting oils.

Scouring powder

Scouring powder mixed with a little oil or washing-up liquid makes an excellent rubbing compound for running-in bearings, etc. Because of its nature it does not impregnate the metal. It will also polish most metals and, again, if used in conjunction with washing-up liquid will leave virtually no scratch marks.

Scouring pads

Scouring pads also make excellent metal polishing pads giving a very bright finish to most types of metal. These pads can be obtained in varying grades. Some are found on the reverse of washing-up sponges and there are two types of these. The coarser one will remove slight marks as well as polish, the finer one giving a very bright finish.

Lining-up holes

Metal skewers are useful for lining up holes on mating parts ready for the insertion of screws, rivets, etc.

More uses for cooking foil

Apart from its use as gasket material, cooking foil is also useful for making shims for packing tools, etc., as well as for placing under work bolted to the milling table to prevent it slipping whilst it is tightened up.

Rust removal

Soap impregnated steel wool pads, frequently sold under the trade name of 'Brillo', also are excellent for metal polishing and will also remove rust from steel without causing too much scoring of the metal.

Paper towels

Paper towels are excellent for general workshop use such as wiping away oil, etc. A roll hung in the workshop will find many uses. When setting work in the lathe it is

always useful to put a piece of white paper behind it as an aid to seeing how accurate it is. Paper towels can be used for this and then afterwards used for wiping the work clean.

Tooth brushes

Tooth brushes are very useful for cleaning the threads on chucks and getting those odd corners of the lathe cleaned out.

Food cans

Cans, such as those in which vegetables, meat products, etc., are sold make excellent shim material for packing lathe tools, etc. Some cans are now made of tinplate whilst others are made of thin aluminium. Both do the job very well but the aluminium ones can be compressed a little if need be to get the tool to the correct height. The long rectangular tins in which sardines and the like are sold make useful storage tins and also ideal sand baths for tempering.

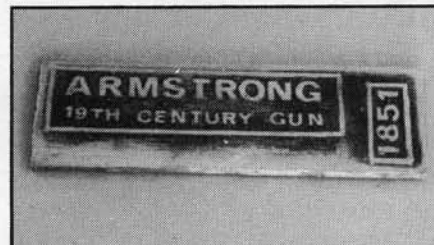
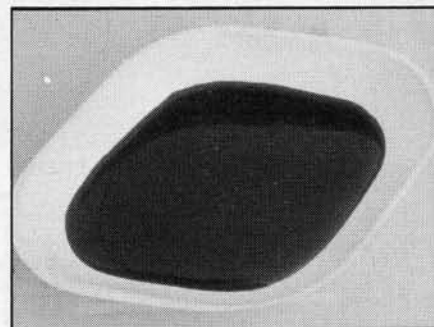
Old knife handles

Old table knife handles, preferably of the bone type (but modern plastic ones are a good substitute), make excellent handles for holding needle files. The handle can be taken off the broken knife blade and the hole which was occupied by the tang of the blade opened out and bushed with a mild steel bush. It is then cross-drilled and tapped for a grub screw and the needle file tang inserted in it and secured with the screw. The flat type of handle gives a particularly good purchase on the file.

Making name plates

Name plates for model locomotives can easily be made at home providing plain lettering is all that is required. Simply polish a piece of brass with emery cloth to ensure there is no grease or dirt. Rub letter transfers on the brass to form the name. The edges can either be formed from the lines that can be found on these transfer sheets or can be ruled on with a drawing pen using drawing ink. Put the brass in a plastic tray and pour on a ten per cent solution of Ferric Chloride. Leave it to soak for about an hour, agitating it about every fifteen minutes. Remove from the solution and wash off.

The brass can then be cut to the correct size and filed to a smooth edge. Better results can be obtained if the plate can be put in the solution face down and to do this the brass must be long enough to allow it to be supported at each end clear of the bottom of the tray. If Ferric Chloride cannot be obtained use printed circuit board etching fluid which can be bought from any good supplier of radio parts. It is supplied ready made up, unlike the original chemical which has to be dissolved. It is, of course, correspondingly dearer. . .



Marking fluids

Normal marking fluids as purchased are very good and convenient. For small areas, however, a felt-tipped pen is just as efficient. Where steel components that are marked out will be subject to a lot of wear before all the marks have been used such as with locomotive frames, then a more permanent form of covering is desirable as marking fluid comes off when in contact with some cutting oils. Clean the steel thoroughly and then cover it with a ten per cent solution of copper sulphate. The pleasant copper colouring on the steel makes it easy to see the marks and they will not disappear when in contact with oil, etc.

Riveting

When closing rivets with snap heads there is always a danger that the lower tool will mark the parent metal. Instead of using a snap on the lower rivet lay the work on a piece of aluminium with a small recess just large enough to take the rivet head. The aluminium will give as the rivet is struck and so the metal will not mark.

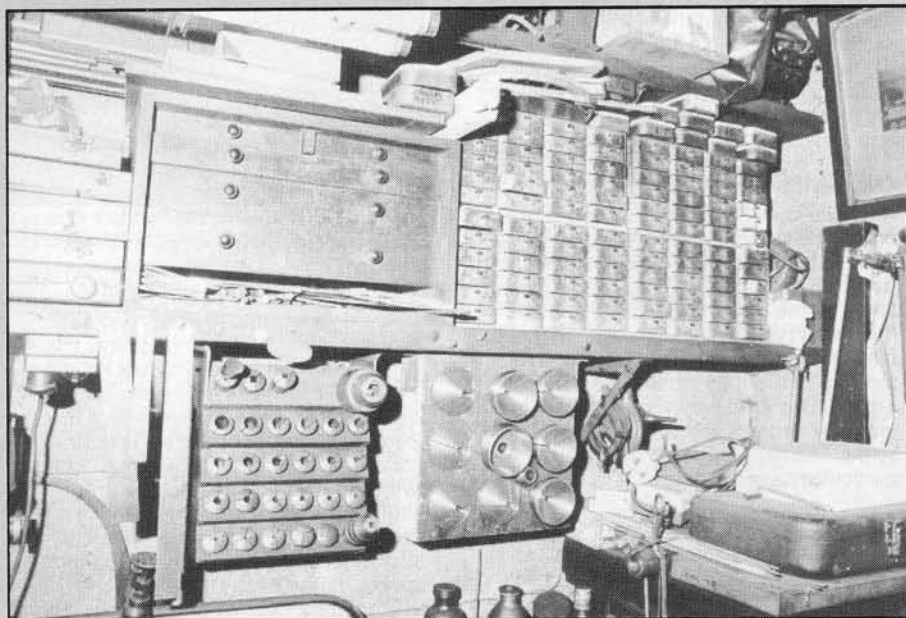
Honing tipped tools

Tipped tools have to be ground with a green grit grinding wheel and then honed with a diamond lap. A good alternative to the diamond lap is to use some grinding paste on a copper strip which will do the job equally well.

Holes in thin sheet

A normal twist drill will not drill holes in thin sheet as it snatches when it passes through. The drill can be specially ground – or 'backed off' as it is known – but this virtually means the ruin of a drill possibly for a single hole. A piece of emery cloth between the work and the drill tip will prevent the snatching effect. For large diameters use one of the special drill bits sold for DIY use in electric drills. Although designed for use on wood these are made of high speed steel and will drill thin sheet very well. They can be sharpened when they become blunt. A slow speed should be used and pressure eased as the drill starts to break through the metal.

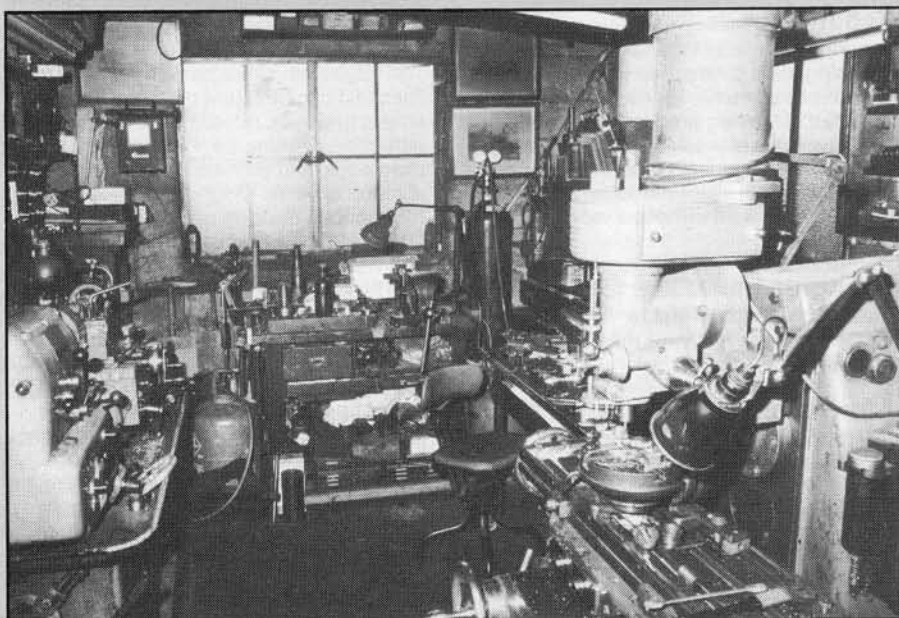
THE HOME WORKSHOP



Fred Beard's workshop with specially made storage for collets and bell chucks.

It's always interesting to look inside other modellers' workshops; armed with camera and notebook, Stan Bray did just that and made some fascinating discoveries

At the heart of all model engineering is the home workshop. For some it is a very temporary affair, for example I know of one very prolific modeller who of necessity works on the table in his dining room. Another lives in a small flat in East London where he has a Myford ML10 lathe which has to be used only at times when the noise it creates will not be heard through the very flimsy walls and floors of the block of flats! These people are just as dedicated and turn out work to the same standard as those of us who are blessed with the good fortune to own a permanent workshop. Such a place need not be large, and again I know of people working in converted cupboards, a disused coal house and one even works in a disused outside lavatory!



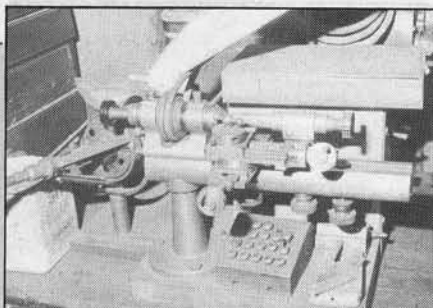
A general view of Fred Beard's workshop shows much development through many years of model engineering. The milling machine is a good example of how modellers can make use of cheaply available equipment - it's the body of one make of machine with the head of another. Result: a compact machine with a very large capacity.

Wherever or whatever the workshop is, it is our little haven, it could even be called a sanctuary. I always feel very privileged when I walk into somebody's workshop and particularly when I am allowed to use my camera. All workshops have the

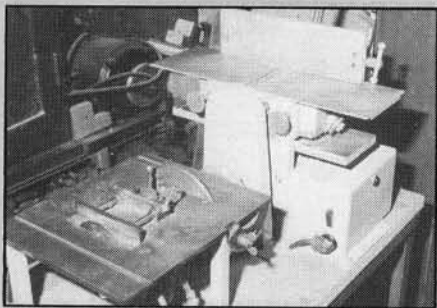
personal stamp of the owner. So much so that I believe it would be possible on many occasions to walk into someone's workshop and identify the owner without being told. Most of us make certain items for our own comfort and have our own way of laying things out so that we can get the maximum use from the workshop. The home-made items vary considerably from person to person. Some will make or renovate much of the major machinery as well as making small tools. Most personalised equipment, however, is probably in the form of storage facilities for it is essential that we can find those bits and pieces easily.

The heart of all workshops is invariably the lathe and it is around this that nearly all seem to be designed. Many these days also contain a small milling machine of some sort while other equipment will vary with the individual. Some will have drilling machines but others will use the miller for this purpose. Some are fitted with a means of cutting metal, others are not and this sort of work must be done the hard way.

On the non-working side nearly all seem to be fitted with a radio and many with cassette players so that the owner can relax whilst making his or her models. Heating is invariably included but this takes many differing forms. Most contain wall charts for



Fred specialised in very fine detail work; here we see a watchmaker's lathe with a set of collets to give the accuracy needed for such work.

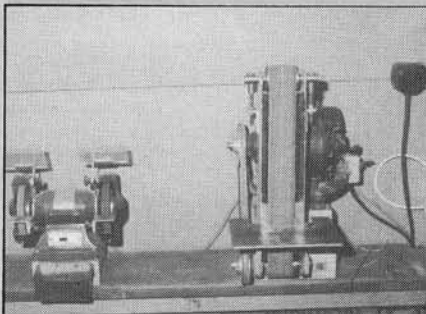


Fred made mainly five inch gauge locomotives and ship models. The work on the ships called for top class woodworking facilities and this is a homemade circular saw bench with a blade two inches in diameter. In the background, a planing machine capable of planing to 10 thousandths of an inch thick.

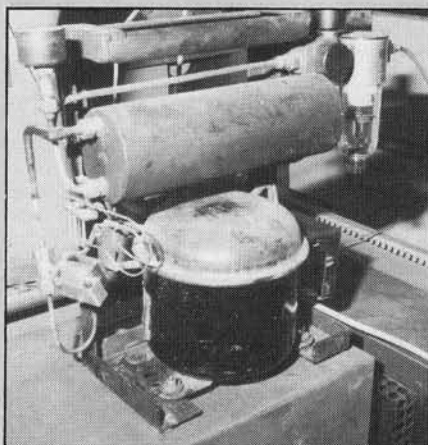
I have recently been able to visit five workshops within a few miles of where I live. All their owners were engaged in the same sort of modelling but the workshops were as different as they could possibly be.

The late **Fred Beard** was possibly one of the best model makers this country has ever seen. He won many awards with his models and some are preserved in the

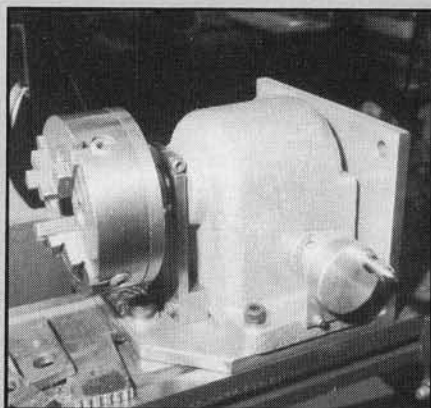
Grinding area in Roger's workshop is separated from the rest to prevent harsh grinding dust from damaging machinery and tools. The belt-sander is homemade.



A compressor (below) is a useful device in any workshop for cleaning away swarf, etc. Roger Nichols made this one from a refrigerator motor and fitted it with a tank, safety valve and pressure gauge. Since refrigerator motors sometimes will not start under pressure, an electronic valve to release the air in the pipe from the compressor to the tank is fitted, ensuring the availability of high pressure air as soon as the device is started.



Dividing heads are very expensive; Roger used a surplus gearbox to do the job at virtually nil cost!

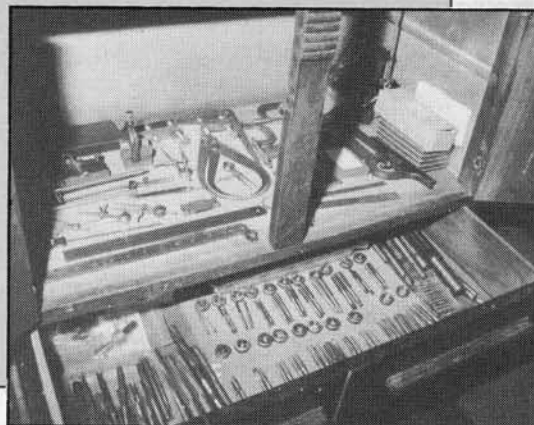


London Science Museum. Although mainly interested in steam locomotives and ships, he included a great deal of tool-making in his work and made models of other artifacts as well. Sadly he died before I had a chance to pay the intended visit. His family however, despite their grief, encouraged me to photograph the workshop in which he had spent many happy hours and where he was busy until an hour or so before his death. As one would expect it was crammed with equipment collected during over half a century of model making including a great deal of home-made equipment. The workshop was situated at the rear of his garage and was cosily heated by a small coal stove in the centre. It was possible for him to sit down and carry out some tasks and was without doubt his favourite retreat.

The workshop of **Roger Nichols** is in an old outbuilding at his home in the Fens. It contains a lathe and a milling machine as well as a grinder and home-made belt sander. There is also a bench drill. The workshop is used for Roger's other interest of electronics as well as for model making. There is a great deal of home-made equipment but of special note, apart from his many home-made small tools, are the belt sander and an electronic drive to the table of the milling machine. On the lathe he has a large handwheel fitted to the mandrel which allows it to be turned over by hand with ease. Another feature is the use of low voltage lighting on the machines. The lights are home-made and are a good safety feature. Heating of the workshop is by night storage heaters in the main, but near the lathe is a home-made floor heating system. It consists of heavy rubber sheeting with a low voltage device made by Roger to raise the temperature.

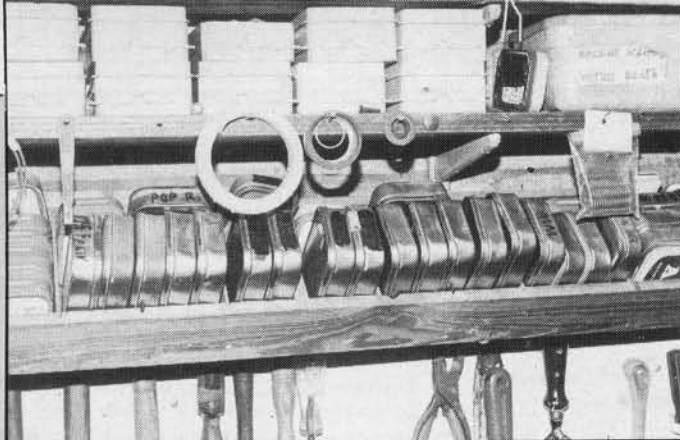
Peter Robinson has a workshop on the rear of his garage. It contains a Myford Super Seven lathe and a milling machine but, in particular, he includes amongst his equipment a high quality band saw. This allows rapid cutting of metal when required. The workshop has a wonderful view across a small valley and is very peaceful. As usual, home-made equipment is much in evidence and there are many bright ideas. Pride of place for home-made work must go to an automatic gear box that he has nearly completed for his lathe. It is quite an effort to construct such a thing and it shows what a perfectionist he is in his engineering. He also has particularly neat storage facilities which allow him to get at any equipment he may need quickly and easily.

Storage of marking-out tools, taps and dies, etc., is kept simple by laying them on boards in a drawer and cupboard.

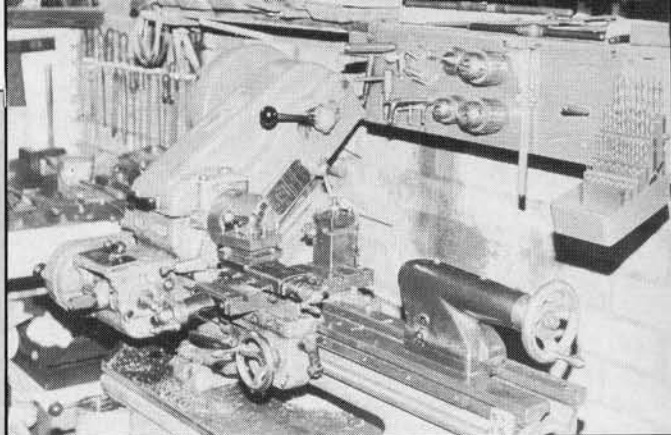


Roger Nichols' workshop; in front of the lathe is screwed a piece of angle with holes drilled in it. It holds chuck keys, etc., which avoids reaching across the machine to get at them.

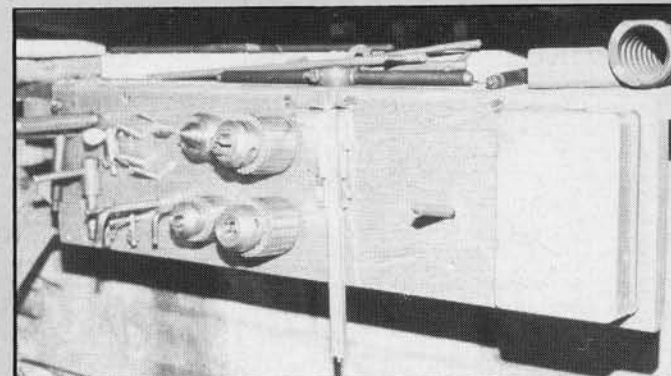
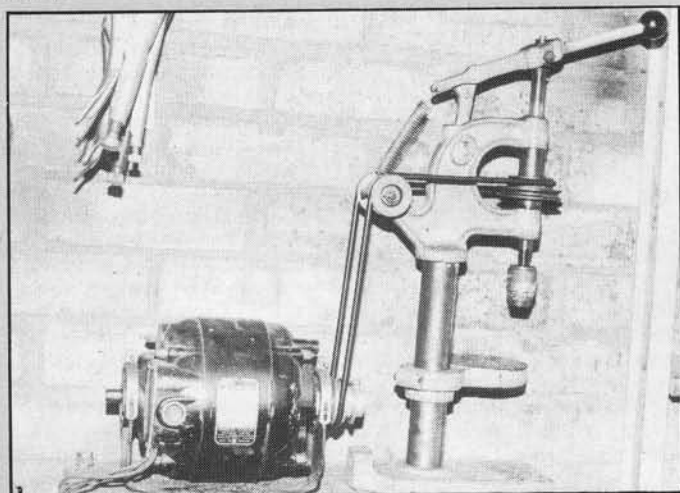
quick reference of tapping drills, etc., and most have one or more pictures of a favourite locomotive or ship or similar subject.



We all use tobacco tins for storage; rather than stack them, Tony Meek angles his at 45 degrees so that he can get at them easily.



Tony Meek's workshop showing, to the right of the tool storage board, a standard drill box screwed to the wall. Neat idea allows for closing when not in use (below).

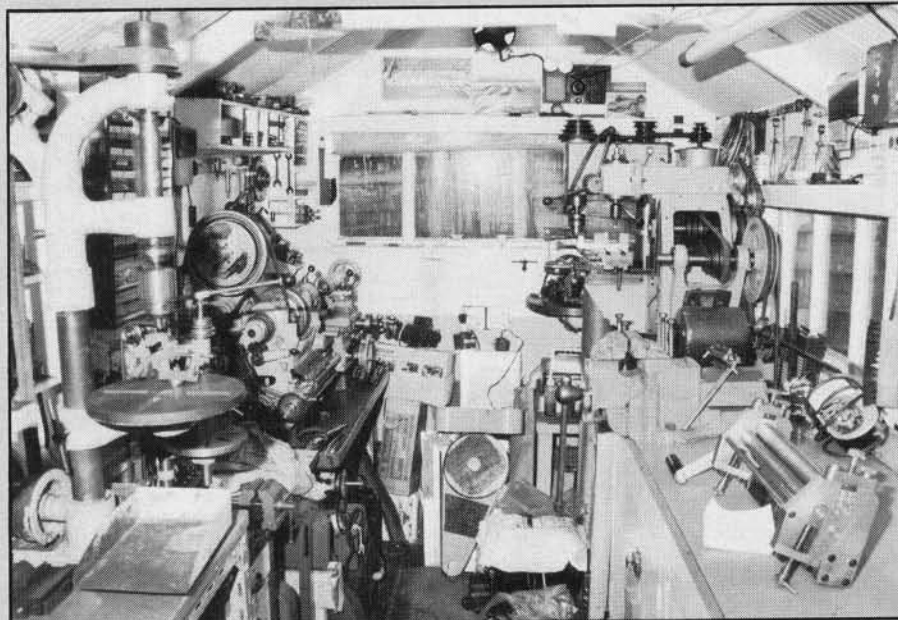


Left, Tony's homemade drilling machine; castings for such machines are readily available. Below, Charlie Ingleby's workshop is only 10ft x 5ft but contains absolutely everything one could wish for making models.



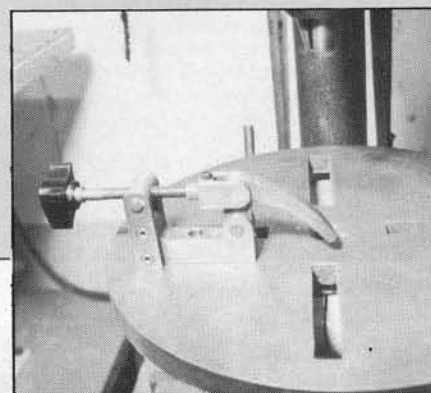
Charlie's homemade band saw is constructed entirely of angle iron and sheet metal and the wheels which convey the blade are from wood with inverted rubber-toothed belts set in the periphery.

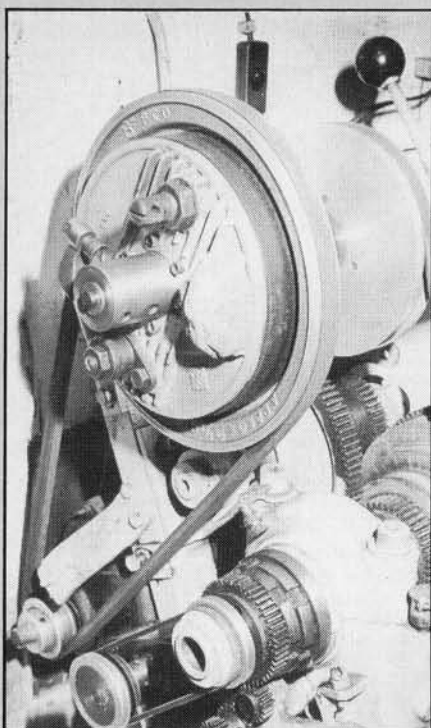
I visited **Tony Meek** to photograph his models but could not, of course, resist the workshop. It is a part of the garage with no partitioning because there just is not room



for it. The workshop contains the inevitable lathe and milling machine, and a home-made drilling machine. Because of the nature of the workshop and the fact that it is gas heated, rust can be a problem and so cabinets with doors to prevent rapid changes of temperature are much in evidence, particularly as far as the more expensive items such as chucks, etc., are concerned. He has several unusual ideas that are worth a mention. Everyone seems to use tobacco tins for storage of small parts and they are ideal for this purpose. They do have one disadvantage, however, in that they tend to fall down when they are stacked on top of each other, and a lower

A neat drill table clamp by Charlie Ingleby. This easily made device makes clamping work to the table a simple matter. Such a tool can be made easily in an hour or so.



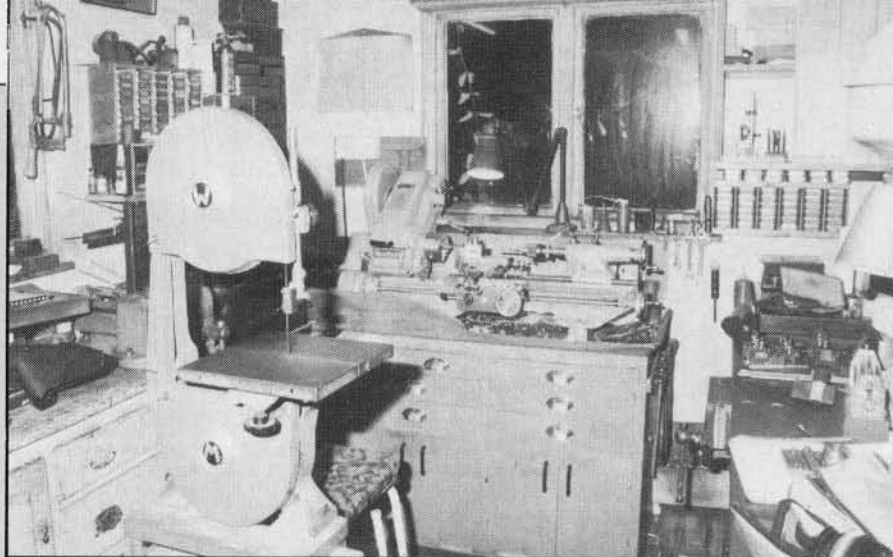


Constant switching on and off can cause damage to lathe motors. Charlie Ingleby made this clever clutch from a Minicar brake drum to avoid this problem. It is operated by a rod through the pulley shaft, the pulley running free until the clutch is engaged. A lump of Plasticine provides balance and the clutch offers perfect control, even allowing the lathe to be inched along.

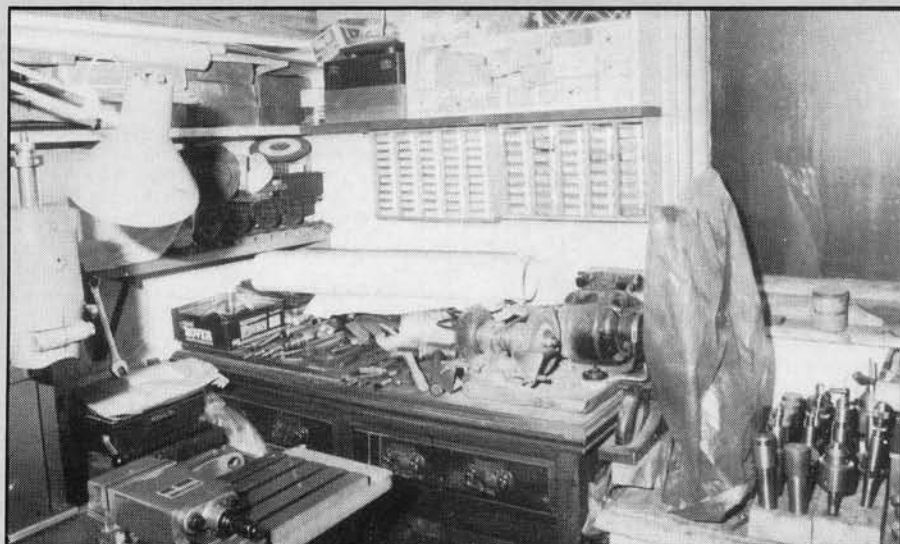
one is pulled from the stack. He has solved this by laying them on their sides at a forty-five degree angle and this makes them readily accessible. Another idea concerns a tin of drills as purchased. In this he has drilled two holes and screwed it to the wall. The drills are readily available and the tin can be closed when finished with, keeping them safely out of harm's way. A third idea was to use a trouser hanger with clips to hold drawings. This allows the drawings, which are folded to show the part in use, to be moved to any place in the workshop and hung on any convenient projection.

Charlie Ingleby works in a wooden shed in the back garden. The shed is about ten feet by six in size but is packed with equipment, all of which he has either renovated or made himself. In spite of all the equipment he is able to find space to work with comparative ease. There is a lathe, a drilling machine, a milling machine and a band saw. The latter is completely home-made, the drive wheels being from wood with inverted toothed belts set in them for the saw blade to run on. He has a home-made grinder and belt sander as well as a great quantity of small tools which he has made over the years. There is just about everything that one could possibly require in a workshop and yet little of it has been bought...

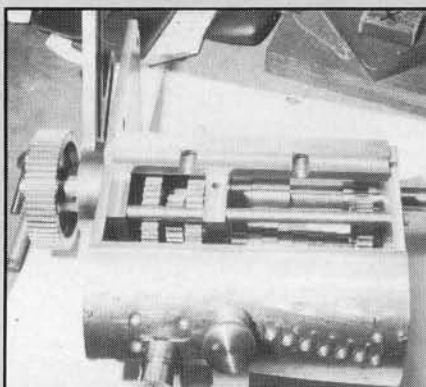
Peter Robinson's storage system is near-perfection; this is just a small part in the shape of a drawer designed for taps, dies, etc.



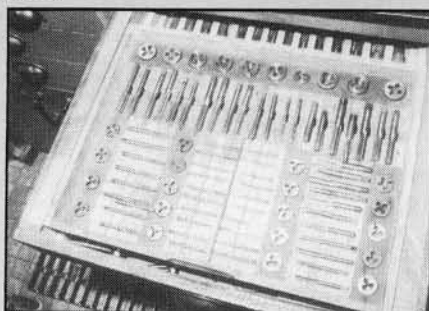
Peter Robinson's workshop; neat layout leads to high-quality workmanship.



Peter protects equipment from abrasive dust from his grinder with plastic sheet.



Peter made this lathe gearbox himself. Construction called for precision and patience but the finished item allows gear cutting set-ups to be made without dismantling the train each time.



Storage units specially made by Peter Robinson. The doors are covered in wall charts for easy reference to drill sizes, etc.

SUPPLIERS LISTINGS

AKRON TOOL SUPPLY CO.

11 Hawthorn Court, 46 Rickmansworth Road, Pinner Green, Middx. HA5 3UN
Tel: 01-429 0551

Among this company's wide range of tools (over 2,000) are some hard-to-find items at attractive prices: a special anniversary catalogue is available price 85p.

A.L. MOORE ENGINEERING

The Old Forge, Stapleford, Melton Mowbray, Leicestershire.
Tel: 05784 261

Models made to order and repairs to models undertaken. Particularly able to specialise in larger scale models. Also supplies a range of paint in railway colours and the Bob Moore Master Lining Pen to enable even the novice to line models easily.

ALYN FOUNDRY

14 Ffordd Lerry, Wrexham, Clwyd LL12 8JD.

Castings for internal combustion engines and a hot air engine.

ALAN GIBSON

Unit 1, Cotenham Barn, Panxworth, Norwich NR13 6JG

Tel: 060549 635

Castings for various locomotives, in particular 7 1/4 in. gauge. Also other model engineering supplies.

ARGO BOOKS LTD.

PO Box 35, Argus House, Boundary Way, Hemel Hempstead, Hertfordshire, HP2 7ST

Publishers of an extensive range of model making and hobby books of all kinds, particularly noted for their fine list of model engineering titles.

ARISTOCRAFT

44 St Marys Lane, Louth, Lincolnshire, LN11 0DT

Tel: 0507 605303

Manufacturers of exhibition standard, scale, super-detailed, ride-on-railway carriages for 5" and 7 1/4/7 1/2" gauge railways. The carriages complement an exhibition standard locomotive, or will carry a full complement of passengers on ground-level track. Various braking systems are available.

ARRAND ENGINEERING

The Forge, Knessington, Nr. Oakham, Leicestershire, LE15 8LN

Tel: 066477 566

Manufacturers of a range of quality taper tooling specifically designed for model engineers. These tools are suited for use with small lathes and milling machines. A recent introduction to the range is a 3in boring head to suit mini-lathes and milling machines. Free catalogues are available on request.

B. ARRIDGE

1 New Village Road, Cottingham, North Humberside, HU16 4LS.

Drawings, cylinder castings, wheels, etc., for 5in gauge beginners Crampton locomotive.

ASHDOWN MODELS

Rose Cottage, Vinehall Road, John's Cross, Robertsbridge, East Sussex, TN32 5JN

Tel: 0580 881144

For thirty years this family business has supplied model engineers with a lot of products 'special' to Ashdown, such as double ended flue brushes, a range of specialist transfers and numerous finishing materials.

ATM CO LTD.

6 New Road, Dagenham, Essex
Tel: 01-593 5593

Suppliers of the entire range of Primus Sievert LPG appliances, invaluable for soldering and silver soldering.

AXMINSTER POWER TOOL CENTRE

Chard Street, Axminster, Devon EX13 5DZ

Tel: 0297 33656/34836

Mail order specialists and suppliers of a wide range of model engineering power tools including lathes, drilling machines and miscellaneous accessories.

A & D BARRACLOUGH LTD.

Elm Street Mill, Elm Street, Burnley, Lancs
Tel: 0282 27048

Manufacturers of the well-known Sharpe 4in rotary table which they supply complete or in kit form. Check with them for availability of other castings.

BASSETT-LOWKE LTD.

Turners Musical Merry-go-Round, Newport Pagnell Road, Wootton, Northants NN4 0HU.

Tel: 0604 706560

A name that needs little introduction to modellers anywhere in the world. The firm mainly specialises in industrial models these days, but they still stock an excellent range of drawings of ships by Harold Underhill. All of which are recognised in the hobby for the high standard they set.

BEATSON & CO (ELECT.) LTD.

17/21 Mowbray Street, Sheffield S3 8EN.
Tel: 0742 760881

Suppliers of all types of electric motors; telephone or send for free list of stock.

BLACKGATES ENGINEERING

20 Wakefield Road, Drighlington, Near Bradford, West Yorkshire, BD11 1EB

Tel: 0532 853652.

The firm stocks Myford lathes and accessories, hand tools, and a wide range of castings for workshop equipment, stationary engines, traction engines and locomotives. Other popular items include a cutter grinder which can be made from their castings, the locomotive "Sweet Pea" and all the castings for the Durham and Yorkshire and other popular traction engines.

BLACK & DECKER LTD.

Cannon Lane, Maidenhead, Berkshire
Tel: 062 882 2130

Well-known range of power tools and accessories including drills, saws and sanders plus the Minicraft range.

BONDS OF EUSTON ROAD

Arundel House, Rumbolds Hill, Midhurst, Sussex
Tel: 073 081 3441

An old-established company dealing in a wide variety of model engineers' requisites.

M. BREEZE

21 Castle Drive, Northborough, Peterborough
Tel: 0778 346565

A range of high quality locomotive drawings in 3 1/2 and 5 inch gauges. Castings either are or will be available for the models. The range includes an L.M.S. Pacific, two L.N.E.R. Pacifics and the L.N.E.R. Green Arrow class as well as other types.

B.J. MODEL ENGINEERING SUPPLIES

24 Brooks Street, Llandudno, North Wales
Tel: 0492 78188

Stockist and agents for Myford lathes and products, Rishton and Amolid Millers, Sharpe 4in. Rotary tables, Scot Urquhart Drill packages, Excel lathes and products, Warco, Stuart Models, Maxitrac locos and track, as well as supplying steel, brass, copper and rivets.

BRIDGEPORT MACHINES

PO Box 22, Forest Road, Leicester LE5 0FJ

Tel: 0533 531122

An old-established and renowned maker of high quality industrial milling machines and accessories.

BRUCE ENGINEERING

Hollow Tree, Riverside, Walton Bridge Road, Shepperton, Middlesex, TW17 8NF

Tel: 0932 245529

Major Stockists of the full range of Stuart Turner Castings, fittings, boilers etc. Makers of the R & B gas engine and the Atmospheric gas engine. Also a full range of cylinder hones for the model engineer sizes from 5/8in to 5in. Loctite products suitable for model engineering are stocked as well. Castings in ferrous and non-ferrous metals.

BRUNEL MODELS

3 Longlands Crescent, Heysham, Lancs. LA3 2NP
Tel: 0524 51400

Suppliers of castings and drawings for stationary engines, locomotives and traction engines. Illustrated catalogue £1.50 UK. £2.50 overseas.

BOXFORD LTD.

Wheatley, Halifax, West Yorkshire, HX3 5AF.
Tel: 0533 531122.

An old-established and renowned maker of high quality industrial milling machines and accessories.

BUCK AND RYAN LTD.

101 Tottenham Court Road, London, W1.

Tel: 01 636 7475.

Suppliers of tools and machinery for the model engineer.

G.M.H. BUNCE & CO LTD.

206 West Street, Fareham, Hampshire
Tel: Fareham 234136

Dealers in machine tools who also stock a wide range of materials and castings of interest to model engineers.

CAMDEN MINIATURE STEAM SERVICES

13 High Street, Rode, Near Bath, Somerset, BA3 6NZ.
Tel: 0373 830151

Suppliers of model engineering and engineering books including many hard to find imports, plus more general books on all forms of steam transport, again many being imported. Steam fittings, nuts, bolts, dies, etc, plus drawings and castings for locos and engines are also available.

CAROUSEL CRAFTS

"Choctaw" 26 Church Drive, Orton Waterville, Peterborough, Cambs PE2 0E2

Tel: 0733 231719

Fairground items are a rarity. This firm stocks many different items, including those that cause the greatest difficulty to the home constructor. They also stock drawings of fairground equipment.

CARRS MODELLING PRODUCTS

Unit 5, Centre 88, Elm Grove, Wimbledon, London, SW19 4EH

Suppliers of solders and in particular the excellent Fry's silver solder range. They also specialise in chemicals for various metal treatments and colourings. Other items stocked include military models, low melt alloys, and scenic products. A stamped addressed envelope is all that is required for a full list.

CHERRY SCALE MODELS

The Stables, 25 Church St., Langham, Oakham, Leicestershire LE15 7JE

Tel: 0572 757392

Builders of high quality models to order. The firm also supplies an excellent range of paints in railway colours and a master lining pen that makes lining of models easy.

CHERRY'S OF RICHMOND

62 Sheen Road, Richmond, Surrey, TW9 1UF
Tel: 01-940 2454

Dealers in finished models of traction engines, locomotives, marine models, stationary engines. Mamod models plus the PAYA range of 0 gauge template locomotives and railwayana.

CHRISTIES

85 Old Brompton Road, London, SW7 3LD
Tel: 01 581 7611

Famous international auctioneers with a specialist division dealing with the auction of models. Sales are held periodically and announced in the modelling press.

CHRONOS LIMITED

95 Victoria Street, St Albans, Herts, AL1 3TH
Tel: 0727 32793

Stockists of a wide range of products for model engineers. These include lathes and machine tools from the Hobbymat, Warco, Amolco, Excel, Naerok and Cowells range etc., together with an extensive stock of other items like measuring equipment, hand tools, taper tooling etc.

J.G.S. CLARKE & CO

The Old School, Love Lane, Denbigh, Clwyd, LL16 3LT
Tel: Denbigh 3118

This company supply drawings and castings for 5in and 7 1/4in gauge locomotives of their own design. There are also the Polly I and Polly II Polly III & IV 0-4-0 kit locomotives, and kits of Passenger/Driving trucks. These trucks can be made from drawings and castings, if preferred.

CLASSIC CLOCK KITS

75 Foxley Lane, Purley, Surrey, CR2 3HP

Mail Order Only

Suppliers of ready-machined kits of parts for a selection of clocks. The kits are self-assembled, using hand tools and polishing papers, into attractive and functional time-pieces to grace any decor.

COLLEGE ENGINEERING SUPPLIES LTD.

2 Sandy Lane, Codsall, Wolverhampton, WV3 9HQ
Tel: 09074 2284

Suppliers of quality machine tool castings non-ferrous metals, plastics, tufnol, P.T.F.E. continuous cast iron (Mechanite) bar and sheet, B.D.M.S. etc. Castings can be

manufactured to your own patterns.

CLERKENWELL SCREWS LTD.

109 Clerkenwell Road, London, EC1R 5BY

Tel: 01-405 6504/1215

Long-time suppliers of all kinds of screws for model engineering purposes; they have many unusual varieties among their range of 230 types and sizes.

COLUMBIA METALS

Columbia House, 19 High Street, Earls Barton,

Northampton

Tel: 0604 810317

Specialist alloy stockholders, including free machining grades of bronze, brass and copper. Based in Northampton, they have branches in London, Halifax and Skegness.

COMPASS HOUSE TOOLS

Compass House, High Street, Rotherfield, East

Sussex, TN6 3LH

Tel: 0892 852968

Suppliers of a range of special offer and discounted tools and equipment for the model engineer. Available by mail order or from their showroom on the Kent-Sussex border, an associate company can supply used equipment and machines.

COWELLS SMALL MACHINE TOOLS LTD

Ravens Green, Little Bentley, Colchester, Essex CO7 8TA

Tel: 0206 251792

Manufacturers of the Cowell range of small lathes, milling machines etc. The range is constantly being developed and includes some items suitable for clock making.

CRAFTS FOR 4 SEASONS

1120 Melfton Road, Syston, Leicester LE1 8HJ

Tel: 0533 607242

The firm stocks very many designs for clocks in which they specialise. They have in particular a wide range of special brasses of types that are often difficult to obtain. They also stock a wide range of tools and other items of value, to the clockmaker in particular, and the model engineer in general.

CROWHURST ENGINEERING

2 Mill Fields Road, Hythe, Kent CT21 4DH.

Tel: 0303 64928

Manufacturers of Crowhurst Engineering brazing hearths in two sizes, purpose built for the model engineer. Strong welded steel framework with refractory able to withstand elevated temperatures. Refractory bricks available separately and special purpose hearths made to order. SAE for leaflet.

C.Z. SCIENTIFIC INSTRUMENTS LTD.

PO Box 71, Ripon Way, Borehamwood, Herts, WD6 1AR

Tel: 01-953 1688

Importers of the well-known Hobbymat and Prazimat lathes from the GDR with an extensive range of accessories including motorized mill/drill and co-ordinate table. Further equipment for the model engineer includes the 'Universal' mini metal-bender. A wood-working lathe is also available in the range.

JMF SUPPLIES

41 Coombe Valley Road, Preston, Weymouth, Dorset DT3 6ML.

Drawing equipment in particular complete drawing units in various sizes.

GRAHAM MACHINERY SALES

Deva House, Sealand Industrial Estate, Chester.

Tel: 0244 376764

Main agent for Myford as well as stocking a variety of secondhand machinery.

DEVON CLOCK KITS

Albion Works, Albion Hill, Exmouth, Devon.

Tel: 0395 263943

Manufacturers of high quality clock kits, available in basic, machined stage or polished, ready to assemble. Tool kits, step-by-step instructions and full after-sales support on skeleton, planetary and Congreve rolling ball types.

DUNN & COMPANY (ENGINEERS & SUPPLIES) LTD
51 Saintfield Road, Crosscar, Downpatrick, N. Ireland BT30 9HY

Tel: 0396 830243

EH BERNFIELD LTD.

7A Southbank, Thames Ditton KT1 0UD

Tel: 01-398 7812

Specialists in imported machinery for watchmaking as well as suppliers of small computer controlled machinery.

ESSEL ENGINEERING LTD.

23 Cavell Road, Billericay, Essex CM11 2HR.

Tel: 0277 659774

One of the very few suppliers of equipment in the Essex area, they are specialists in the Hobbymat range and can supply accessories for the lathe not available from the manufacturers. They also supply small tools and some metal and castings.

GABRO ENGINEERING LTD.

16 Royce Road, Fleming Way, Crawley, West Sussex RH10 2XN.

Tel: 0293 31932

Suppliers of a range of metal bending machines in various sizes, many suitable for model engineering.

G & M TOOLS

The Mill, Mill Lane, Ashington, Sussex.

Tel: 0903 892150

Suppliers of secondhand machinery of all sorts as well as stockists for some new machines.

R. A. ATKINS LTD.

Hunts Hill House, Hunts Hill, Normandy, Guildford,

Surrey GU3 2AM.

Tel: 0483 811145

Suppliers of machine tools including the Myford Range.

DAVALL GEAR COMPANY LTD.

Welham Green, Hatfield, Herts, AL9 7JB

Tel: 07072 65432

Manufacturers of all types of power transmission gearing, with over 2,400 standard stock gears. Toothed timing belt drives also available.

DUPLEX ELECTRIC TOOLS

Old Barn Lane, Kenley, Surrey CR2 5YY.

Tel: 01-660 3731

Toolpost grinders and other useful workshop tools.

JOHN M. ELLIS

Unit 3, Fairfield Drive, Off Stone Lane, Kinver, West

Midlands, DY1 6EQ

Tel: 0384 872122

Although particularly specialising in making boilers for the smaller gauges right up to 10 1/4 inch gauge as well as for traction engines of all scales, the firm also makes an interesting range of forged coupling hooks which look highly authentic as well as having the additional strength associated with the forging process.

EMCO MAIER LTD.

10 Woodshots Meadow, Croxley Green, Watford,

Herts, WD1 8YZ

Tel: 0923 50051

U.K. importers of the EMCO range of machine tools which are so well established in the hobby as to probably need no description. It includes the well known Unimat and the Compact 5 and Compact 8 lathes. The range has both milling attachments for the lathes and milling machines in their own right. They also stock accessories and other machines likely to be of use to the model engineer.

EURO PRECISION TOOLS LTD

Unit 1, Venture Industrial Park, Ackworth Road,

Hilsea, Portsmouth, P03 5JP

Tel: 0705 667331

The firm stocks the Unimat range of machines and, in particular, specialise in the Unimat 1.

EVERETT MODEL ENGINEERING SUPPLIES

24 Station Road, Meopham, Kent

Tel: 0474 814295

Suppliers of metal, drawings, castings, etc. for locomotives and stationary steam engines.

EXCEL MACHINE TOOLS

Unit 1, Colliery Lane, Exhall, Coventry CV7 9NW

Tel: 0203 365255

A wide range of good quality imported machines, in particular larger size milling machines from the Far East.

EXPO (DRILLS) LTD.

Clock Tower Works, Warsash, Hampshire, SO3 6FH

Tel: 04895 83966

A wide range of very useful miniature electric powered hand tools, in particular the Saturn series of drills.

FAN AND MOTOR CENTRE

65 Sidney Street, London, E1 2NH

Tel: 01-247 3710

A large stock of new and second hand electric motors suitable for all model engineering purposes.

FLAMEFAST LTD.

Pendlebury Industrial Estate, Bridge Street,

Swinton, Manchester M27 1FJ

Tel: 061-793 9333

Manufacturers of gas equipment for the model engineer; range includes soldering torches, small furnaces, casting tools and equipment, and brazing torches and materials.

FYNE FORT FITTINGS (FRESHWATER I.O.W.)

Clarence Boatyard, East Cowes, Isle of Wight, UK PO 32 6EZ

Tel: 0983 293633

Manufacturers of live steam fittings for model locomotives, marine, traction and stationary engines. They ship worldwide and will supply special fittings up to full size to order.

PHIL W. GIBBONS

Six Score Road, Langtoft Common, Market Deeping,

Peterborough PE6 9QD

Tel: 0778 347515 or 0780 63458 (evenings)

A foundry specialising in castings for the model engineer. Although they have some patterns of their own, basically their work is making castings to customers' own specifications. Either from patterns or

drawings. A useful service not always easy to obtain elsewhere.

G.L.R. DISTRIBUTORS LTD.

Great Northern Works, Hartham Lane, Hertford, Hertfordshire

Tel: 0992 552962

Suppliers and stockists of tools and raw materials of all kinds including taper tooling, green grit wheels, aluminium, brass, copper (all types), drill sets, blanks, drills, dies, grinding wheels, heavy metal, non-corrosive balls, carbide-tipped tools. Drawings and castings for "Dolphur" 5in narrow gauge 2-8-4 tank loco. Catalogue available at 75p — everything for the model engineer.

DAVE GOODWIN

43 High Street, Rishton, Blackburn, Lancs, BB1 4JZ

Tel: 0254 885836

Supplier of top quality castings for loco's mainly to M.E. designs, also castings to customers' patterns in iron, gun metal, aluminium or brass. Sole supplier of castings for several designs. Stockist for nuts and bolts, taps and dies, bar sections and other miscellaneous items.

GRAHAM ENGINEERING LTD

Alpine House, Roebuck Lane, West Bromwich, Nr.

Birmingham West Midlands, B70 6QP

Tel: 021 525 3133

This company supply a wide range of tooling, and have just introduced a mail order service — offering three day delivery on milling machines, lathes, chucks and measuring equipment.

T.S. HARRISON & SONS LTD.

Union Street, Heckmondwike, Yorkshire, WF16 0HN

Tel: 0924 403751/6 and 0924 409361/6

A 'big' industrial lathe manufacturer who has developed a model specifically for the model engineering hobby market; this is the high quality Harrison M250.

HEGNER (UK) LTD.

Wymondley House, Earsham Road, Hailsham, E.

Sussex BN27 3LE.

Tel: 0323 442440

Saws and associated woodworking power equipment.

N.S. HEMINGWAY

30 Links View, Half Acre, Rochdale, OL11 4DD

Tel: Rochdale 45404

Suppliers of tools, free cutting steel, Allen screws etc, but specialising in kits to make your own workshop equipment. Extensive range of designs available; Boring heads, dividing heads, knurling tool, taper turning attachment etc, plus all the George Thomas designs.

D. HEWSON

73 Victoria Road, Barnetby, DN38 6HY

Tel: 0652 6884080 (evenings)

Precision lost wax castings for 5in gauge loco's and scale 5in gauge railway wagons. Also castings supplied to customers patterns by arrangement.

HIRSH JACOBSON MERCHANDISING CO LTD.

91 Marylebone High Street, London W1M 3DE

Carbide scribers, Diamond dressers, Diamond needle files, HSS twist drills, HSS hacksaw blades, Calipers, pocket microscopes and air grinders can all be supplied by this company, who pride themselves on their reputation for fast delivery.

F.L. HUNT & CO.

48 Chapel Street, Manchester M3 7AA

Tel: 061 834 1465

A long established firm of foundry suppliers who specialise in the small quantities needed by the home foundryman. The range is vast and it is suggested that you phone or write for a quotation stating your exact needs — despatch is immediate to any address in the U.K.

HUCAR ENGINEERING SUPPLIES

1 Copeland St, Kingswood, NSW 2750, Australia

Tel: 047 31 3950

Major Australian supplier of materials, castings, plans, literature and fittings for the live steam and scale model enthusiast. Enquiries and sales can be made by post or telephone and facilities exist for model construction and repair.

IRON HORSE ENGINEERING LTD.

113 Stein Road, Southbourne, Emsworth, Hants,

PO10 8LS

Tel: 0243 373624

Manufacturers of Passenger carrying railways for parks, estates and gardens. Their services include everything from planning through to railway operation for both private and commercial lines. The firm specialise in a range of complete sectional track in all popular gauges up to 10 1/4in including a portable raised level system.

JABUS ENGINEERING LTD.

Ash Barn, Braunton, N. Devon, EC33 2EG

Tel: 0271 815310

The range of Jabus Artisan quality equipment suitable for model engineers includes small diameter turning, tailstock taper turning and spherical turning tools, and a 100mm precision rotary table and accessories. The company can also supply castings and drawings for the Metalmaster Universal Machine Tool.

J.A. JACKSON

Tufagh, Ramsden Park Road, Ramsden Bellhouse,

Billericay, Essex, CM11 1NG**Tel: 0258 71044**

Designer and supplier of the "Manumatic" Boring and Facing Head which gained high distinction in its class at the 1987 Model Engineer Exhibition. Drawings castings and instructions for use of the device are obtainable only from this source.

J.P.H. ENGINEERING

7 Bournemouth Park Road, Southend on Sea, Essex, SS2 5J0

Tel: 0702 66688

This firm specialises at the moment only in the supply of castings for the John Haining designs. These include most of the traction engines and all the other published designs such as the Dairy Engine, the living van and the water cart.

L.C. JAY & SON LTD.

19-21 Oak Street, Norwich NR6 7DT

Tel: 0603 628798

Specialist foundry willing to cast from customers' own patterns in iron bronze or alloy. They also stock castings for popular designs as well as for a couple of their own specialities. These include a neat little lathe suitable for home construction.

A. KELLETT

2a Egerton Street, Denton, Manchester, M34 3LU

Tel: 061 320 0047

Gearmakers of repute and happy to supply small quantities to customers' requirements.

KENNION BROS (HERTFORD) LTD.

2 Railway Place, Hertford, SG13 7BT

Tel: 0992 582573

Founded in 1901 this is the oldest model engineering firm of them all. Their stocks include a large range of materials and small tools, and they stock drawings and castings for '0' gauge to 7 1/4in gauge models, and two small steam pumps suitable for model locomotives and stationary plants. Their castings include some old and rare designs.

LEEDA LTD.

14 Cannon Street, Southampton, SO9 2RB

Principally manufacturers of fishing equipment, this company's magnifying spectacles (marketed as an aid to fly-tying) are of equal value to model engineers.

LINAZE LTD.

PO Box 343, Old Marsh Lane, Maidenhead, Berks, SL6 0EJ

Tel: 0628 74344

Manufacturers of a demonstration gyroscope with balanced flywheel running on ball bearings. Useful as a teaching aid, and also as a high quality executive toy for children and adults, it is available direct from the manufacturer.

LOCOMOTIVE DESIGN CO.

Nyala, Scruton, Northallerton, N. Yorks, DL7 9QZ

Tel: 0609 748315

A recently-established company specialising in 2 1/2in gauge designs who also market the extensive range of castings available from Dave Goodwin.

LOCO STEAM MODEL ENGINEERS

Wyndwood, King Street, Neatishead, Norwich, NR12 8BW

Tel: 0692 630683

Specialist suppliers of castings, materials etc. for building '0' and '1' gauge models, primarily steam locomotives coal, butane or meths, fired, plus other, more general, model engineering equipment.

L.S.M. ENGINEERING

92 Eastfield Road, Wollaston, Northamptonshire, N9 7RU

Tel: 0933 665409

Builders and suppliers of parts, castings and drawings for the larger scale traction engine model.

MACC MODEL ENGINEER SUPPLIES

45A Saville Street, Macclesfield SK11 7LQ.

Tel: 0625 33938

Stuart Models and other model engineering supplies available.

MACHINE MART LTD.

211 Lower Parliament Street, Nottingham, NG1 1GN

Tel: 0602 411200

A machinery 'superstore', with branches throughout the midlands and north of England. They can supply a range of machine tools, mainly imported, and a large range of electric motors and starters.

MACHINE TOOL SALES/PAISLEY MACHINE TOOLS

Sparks Lane, Cuckfield, W. Sussex, RH7 5JP

Tel: 0444 413122/04446 42266

MTS supply the famous British Matosa rotating centres, directly to customers and therefore at a special price.

PMT, who share the works and management, offer the full range of Naerok machinery.

MAIDSTONE ENGINEERING SERVICES

50 Hedley Street, Maidstone, Kent.

Tel: 0622 762005

A leading supplier for model engineers, continually extending their range, BMS, stainless steel, copper, brass, phos-bronze etc, in various sections, along with sundries, fittings, books, drawings, castings and tools

are all available. They have a mail order service for those unable to visit the shop.

MARDYKE MINIATURE RAILWAYS LTD.

No 3 Factory, Lambs Lane, Rainham, Essex, RM13 9XL

Tel: 04027 54618

Builders and suppliers of ready-to-run locomotives and rolling stock for the large gauge enthusiast or the commercial operator.

A. MARKS (MODELOY)

3 Old Hall Close, Loughton-en-le-Morthen, Sheffield, S31 7YZ

Tel: 0909 563940

Manufacturers of machine tool accessories and other related materials including centre drill holders and chuck adaptors, etc

MASON & GANTLETT LTD.

29 Surrey Street, Norwich, NR1 3NX

Tel: 0603 746998

Suppliers of a wide range of magnifiers and optical equipment. Manufacturers of the Versator binocular headband magnifier.

MERCER SKILLED CRAFTS LTD.

Springfield Works, Moorside, Cleckheaton, BD19 6JT

Tel: 0274 872861/874586

Stockists of machine tools, measuring equipment, workshop equipment, tools and tooling for machines, used machines and equipment. They offer most leading makes from stock.

MICROW ENGINEERING

5 Lindsay Street, Kettering, Northants

Manufacturers of machine tool accessories of high quality, in particular a double-ended sliding die holder.

MILNER ENGINEERING

Old School, Main Road, Higher Kinnerton, Chester, CH4 9AJ

Tel: 0244 660791

Consultants, designers and manufacturers of model locomotives and equipment in 7 1/4in to 15in gauge.

MODEL ENGINEERS SUPPLIES

1 Denmark Street, Bletchley, Milton Keynes.

Tel: 0908 37493

Stockists of metal, screws, rivets, etc., as well as taps, dies and other small hand tools.

MODEL ENGINEERING SUPPLIES AND SERVICES

Mesas House, Alma Street, St. Helens, Lancs WA9 3AR

Tel: 0744 53634/22294

Castings are stocked for many engines including Gemma, Scamp and Stuart Turner. Agents for Myford, Warco, Cowells, and Hobbymat. The company has recently developed several new products, many for the Hobbymat lathe. New to the range is their lock-on milling cutter chuck, and quick change tool post.

MODEL ENGINEER PLANS SERVICE, ASP

Argus House, Boundary Way, Hemel Hempstead, Hertfordshire HP2 7JT

Whatever your interest in Model Engineering you are almost certain to find a drawing in the extensive Model Engineer Plans Service range which covers traction Engines, locomotives, stationary steam engines, boilers, fittings, petrol engines, workshop equipment and much more. A fully illustrated catalogue (Handbook 2) is available from the above address price £2.00 plus 35p p&p. which is refundable on your first mail order worth over £5.00.

MODEL ENGINEERING SERVICES

Pipworth Farm, Pipworth Lane, Eckington, Sheffield S31 9EY

Tel: 0246 433218

A wide range of castings and drawings for workshop equipment. These include a milling machine and surface grinder, dividing head, and lapping machine as well as many smaller items. Some of the larger castings are available ready machined. They produce castings for two different cutter grinders for those wishing to sharpen their own milling cutters etc.

MODEL WHEELWRIGHT

1 Field Way, Fleet, Aldershot, Hants GU13 8ER.

Tel: 0252 614496**MILL HILL SUPPLIES**

66 The Street, Crowmarsh Gifford, Nr. Wallington, Oxon OX10 8ES

Tel: 0491 38653

Specialist mail order tools suppliers; a free list is available on request.

M.J. ENGINEERING

Manor Hatch, 63B Southampton Road, Ringwood, Hants, BH24 1HE

Tel: Ringwood 6234

Drawings and castings for model traction engines in the smaller scales, and also two locomotives, a 7 3/4in NG 0-4-0 Bagnall, and Ariel, and 5in gauge re-built Merchant Navy. Add to this a comprehensive range of Myford equipment and spares, David Lammas tooling aids, materials, books etc, and you have the full picture.

MOTORUN PHASE CONVERTERS

23 Waldengrave Road, Teddington, Middlesex

Tel: 01-997 0242

Specialist in the supply of electrical phase convertors, particularly useful when purchasing secondhand machinery.

D. MACKAY

85 East Road, Cambridge CB1 1BY

Tel: 0223 63132

Not primarily model engineer suppliers, the firm stocks an exceptionally large range of tools and machinery. They also stock and will cut to size brass steel etc, but that service is for callers only. Stuart Turner castings are also available.

MALDEN TRANSFORMERS

134 London Road, Kingston on Thames

Tel: 01 546 7534

A large range of new and secondhand electric motors as well as phase convertors, transformers etc.

MAXITRAK

Rothiemay, Offham Road, West Malling, Kent, ME19 6RG

Tel: 0732 840660

Manufacturers of large scale live steam and diesel models in both narrow and standard gauges; the locos are available in either kit or ready-to-run form.

MEDDINGS SALES LTD.

Lee Mill Industrial Estate, Ivybridge, Devonshire

PL21 9LL**Tel: 07554 3277**

Manufacturers of a range of high precision drilling machines among other quality machine tools.

MERIDIAN CLOCKS

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Mail Order Only

Suppliers of an excellent series of specialist books by the well-known horological author John Wilding. The books make an excellent reference source for any horologist, amateur or professional.

MICROFLAME (UK) LTD.

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Tel: 0379 4813

Importers and distributors of the Dremel range of precision hand-held power tools and Microflame soldering, brazing and welding tools and accessories.

N. MOLE & CO (MACHINE TOOLS) LTD.

5 Tolpits Lane, Watford, Hertfordshire, WD1 8LU

Tel: Watford 43135

A supplier of lathes, milling machines etc.

MY KITS

1A Holly Close, West Winch, Kings Lynn, PE3 0PW

Makers of a small simple indexing device for the Myford 7 series lathes.

MYFORD LTD.

Chilwell Road, Beeston, Nottingham, NG9 1ER.

Myford are the country's foremost manufacturer of screwcutting centre lathes up to 280mm (11in) swing. Included in the Myford range are the series 10, series 7 and the new 254 plus centre lathes, plus a choice of three vertical milling machines from the popular VM series. All Myford machines are backed by a comprehensive range of accessories and ancillary equipment.

Z.R.D. NADIRSHAW

441 West Green Road, Tottenham, London, N15

Tel: 01-888 1865/4613

Suppliers of taps, dies, drills and reamers in all popular model engineers' sizes; one-off sizes are available, contact for a quote. Send a large SAE for price list.

NAEROCK LTD.

Unit A, Ffrwdgrech Industrial Estate, Brecon, Powys, Wales

Suppliers of quality imported machine tools, now moved to larger premises, the company's range has been expanded to include cordless drilling machines and professional woodworking machinery from Italy, as well as a range of German woodcutting saws.

NUTOOL GROUP

Carcrafi Industrial Estate, Wellsyke Road, Adwick-le-Street, Doncaster, S. Yorkshire.

Nu-Tools have one of the largest ranges of products and machines for the model engineer. Lathes for wood or metal, even a combination lathe, milling, drilling machine. A range of 9 drills, 3 milling machines, and grinders from 5in to 8in, and a 10in Wetstone grinder.

F. O'BRIEN & CO LTD.

Swadlincote, Burton-on-Trent, DE11 0PH

Tel: 0282 217588

Manufacturers of drilling machines, including the Star range and, in particular, the Stratrite (Fabco) series.

H.L. PEARSON

5 Ruskin Avenue, The Straits, Sedgley, Dudley

Manufacturers of parts for model cannon which can be obtained as part machines or plain castings. The models are supplied with proper cast iron barrels and look most realistic when completed. The sort of odd project to fill in the shorter periods of time spent in the workshop.

PEATOL MACHINE TOOLS

19 Knightlow Road, Harborne, Birmingham B17 8PS

Manufacturers and suppliers of the Peatol Micro Lathe and its associated spares.

PHOENIX MACHINE TOOLS

Whitacre Road, Whitacre Road Ind. Est. Nuneaton, Works. CV11 6UT
Tel: 0203 370181

PRO-AM MACHINE TOOLS & MODEL ENGINEERS SUPPLY LTD.

Felmington, North Walsham, Norfolk.

Tel: 0263 732661

Excellent source of both new and used machine tools in most sizes.

PRECISION ENGINEERS LTD.

Mary Street, Rishton, Blackburn BB1 4RF

Tel: 0254 888001

Manufacturers of the Rishton VM series of Vertical Milling Machines and accessories, the Union range of grinding, polishing and belt grinding machines, and the clarendon range of hand-operated presses.

PRECISION SERVICES

Princes Drive, Crackley Industrial Estate, Kenilworth Warwickshire, CV8 2FD

Tel: 0926 59142

Specialists in the supply of quality measuring instruments. The firm also stocks the Unimat range of machine tools.

PROOPS BROS

21 Masens Avenue, Wealdstone, Middx. HA3 5AH

Tel: 01-861 5258 (Mail Order)

Suppliers and stockists of a very wide range of tools, materials and model engineering sundries, many at bargain prices. For a fully illustrated catalogue please send 75p. Trade enquiries are more than welcome.

PROOPS DISTRIBUTORS

Heybridge Estate, Castle Road, London, NW1 8TD.

Tel: 01 267 6911

This company specialises in a very wide range of small items likely to be of special interest to model engineers. They offer good value and callers are welcome to browse around their 10,000 sq ft warehouse.

QUALTERS & SMITH

Smith Wilkinson Ltd., Albion Road, Carlton, Barnsley, South Yorkshire, S71 3HW.

Tel: 0226 287561

Manufacturers of high quality, high precision drilling machines.

A.J. REEVES & CO LTD.

Holly Lane, Marston Green, Birmingham, B37 7AW.

Tel: 021 779 6831/2/3

Probably the largest stock of castings and materials specially aimed at the engineering modeller. A wide range of 3 1/2, 5 and 7 1/4 in gauge locomotives, 1, 1 1/2, 2 and 3 in scale traction engines and road vehicles and a selection of stationary engines, together with workshop equipment castings are carried in permanent stock. Raw materials, drawings, nuts, bolts and rivets are stocked in abundance.

P.J. RICH

66 Cwm Cwddy Drive, Rhiwderin, Gwent

Tel: 0633 893156

Drawings and castings for several locomotives of exceptionally high standard. All non-published designs. A fine example is their LMS Patriot in 5 in gauge.

REJON MACHINE TOOLS.

1 Vicarage Close, Foulton, Thetford, Norfolk

Tel: 036 621256.

Suppliers of machinery including equipment by Myford, and EMCO. Also secondhand machinery available.

RJH PRECISION CASTINGS LTD

19 Wesse Trade Centre, Ringwood Road, Poole BH12 3PF

Tel: 0202 732477

Specialist custom castings service, including lost wax ROTAGRIIP LTD.

16-20 Lodge Road, Hockley, Birmingham B37 7HT

Tel: 021 551 1566

Suppliers of a wide range of tools and equipment for the model and professional engineer. A speciality of the house is the supply of chuck spares. The catalogue, obtainable on receipt of a large s.a.e. is a useful item to have in the workshop filing system. Personal callers are welcome and mail orders are dealt with as quickly as possible.

SCOT URQUHART

371-373a Earlsfield Road, Earlsfield, London, SW18 3DQ

Tel: 01-874 5708/5709/9690

Suppliers and manufacturers of a various range of machine tools and equipment. Their most popular product is the Astra Mk. VII all geared head vertical milling/boring/drilling and tapping machine. Also worth a mention is the range of 32 sizes of rotary tables, the 5, 6 and 8 in for model engineers.

SERT PRECISION TOOLS

3 The Broadway Centre, Farnham Common, Bucks.

Tel: 02814 2337

Suppliers of a very wide range of second-hand tools, machines, measuring instruments and other goodies for the model engineer. Fast mail order service and stockists of Hobbymat, Warco, Cowells, Toyo, Stuart Turner, Nu-Tools, Toolmex and Naerok

J. SIMBLE & SONS

The Broadway, Queens Road, Watford, Herts

Tel: 0923 26052

One of the largest tool stockists in the home counties. Can meet most requirements of the model engineer from stock.

NATHAN SHESTOPAL LTD.

Unit 2, Sapcote Trading Centre, 374 High Road, Willesden NW10 2DH

Tel: 01 451 6188

Stockists of a wide variety of machine tools and accessories and principal source of supply for Primus Sievert gas equipment.

SOUTHWORTH ENGINES

6 Kennet Vale, Brockwell, Chesterfield, Derby S40 4EW

Tel: 0246 79153

Publisher of 'Some early Robey Steam Engines', 43 pages including 54 photographs and drawings. £3.90 including postage and packing, £5.60 airmail.

NORMAN SPINK

52 Highfield Lane, Chestefield, S41 8AY.

Tel: 0246 277010 anytime

A specialist in locomotive castings and drawings of which they stock a very wide range. Noted for high quality castings and prompt mail order despatch. They have several designs of their own including a 5in gauge British Railways 2-10-0 all of which are proving to be highly popular. The firm also stocks the TOYO range of machines.

STEAM REPLICAS LTD.

Unit 5 Carcroft Common Industrial Estate.

Brooklands Road, Carcroft, Doncaster DN6 7BA.

Traction engines either complete or as castings in four and six inch scales.

STANTON-THOMPSON LTD.

Lys Mill, Watlington, Oxon

Tel: 049 161 3515

Boring, facing and bottoming, threading and recessing operations in bores from as small as 1/8in are simplified by the range of Orkan tools distributed by this company. Made from high speed steel and relief ground right round for extended life and easy re-sharpening, there are 13 sizes standard and extra length cutting head diameters 1/8 to 5/8in.

STEPHEN BARRETT

Kenmore House, 5 Agden Road, Sheffield S7 1LY

Suppliers of photo-etching materials suitable for making nameplates, etc.

STUART MODELS LTD.

Wedmore Road, Cheddar, Somerset, BS27 3EB

Tel: 0934 743470

Makers of the famous range of Stuart Turner Models and also the Morewood model boilers. The range needs little introduction being famous the world over. Boilers can be made to order to any design or scale.

KEN SWAN

Dipwood Way, Rowlands Gill, Tyne-and-Wear, NE39 1DH

Tel: 0207 542560

Specialist in 7 1/4 in gauge prototypes and supplier of castings and materials for a range of models in this size.

SWIFT ENGINEERING

Station Drive, Market Bosworth, Leicestershire.

Tel: 0455 291956.

Secondhand machinery of all sorts.

SWINDON

29 Church Walk North, Swindon, Wilts, SN2 3DH

Makers of copper boilers to order for stationary engines, locomotives, or traction engines.

TECHNO LTD.

22 The Green, Woburn, Bucks HP10 0EJ

Tel: 06285 20980

Suppliers of a new electronically controlled milling machine imported from West Germany.

T.E.E. PUBLISHING

The Edwards Centre, Regent Street, Hinckley, Leicestershire

Tel: 0455 637173

Publishers and suppliers of books on the hobby and a regular magazine for model engineers. A useful source for back issues of Model Engineer magazine.

A.G. THOMAS (BRADFORD) LTD.

Tompson House, Heaton Road, Bradford, West Yorks, BD8 8RD

Tel: 0274 497171

A mail order tool catalogue for the model engineer, watchmaker and clockmaker, plus clock movements, clock ornaments and repair material.

JOHN THOMPSON

1 Fieldway, Fleet, Hampshire, GU13 8ER

The catalogue provides an introduction to the fascinating world of model horse-drawn vehicles. It lists plans of the carts, carriages and caravans suitable for the novice and the expert, together with the books and kits which are available from the company. Mail order only.

ALEC TIRANTI LTD.

70 High Street, Theale, Reading, Berkshire, RG7 5AR

Tel: 0374 302775

Suppliers of many different kinds of tools, materials and equipment for sculpture, modelling, mouldmaking and casting. Better known to the modelling world for their Silicone Rubbers and White Metals, which are stocked in a variety of types, they also manufacture the Centricast Centrifugal Casting and Mouldmaking Machine.

B & R TITE

17 Crescent Road, Colwall, Malvern, Worcs, WR13 6QW

Makers of a range of drawings and castings for stationary and marine steam engines, also drawings, castings and materials for a modern 60cc twin cylinder overhead camshaft petrol engine.

TOWN BENT ENGINEERING CO.

Chapel Works, Barnes Street, Clayton Le Moors,

Accrington BB5 5PF

Tel: 0254 31505

This firm has recently taken over the production of the Sharp Milling Machine as well as the other Sharp products such as rotary tables, etc. A well-established engineering firm in their own right, they have considerably improved what was already a very fine milling machine in the first place, making it amongst the finest available for the home workshop. It is British made throughout, something of which the firm are very proud.

TOWNLEY TIMES

Windsor Road, Todmodern, Lancashire OL14 5JY

Tel: 070 681 4931

A range of tools and tooling too vast to be separately listed; send for a free copy of "Townley Times" for a list of bargains.

TRACY TOOLS LTD.

2 Mayors Avenue, Dartmouth, South Devon

Tel: 08043 3134

Suppliers of general model engineering tools; useful catalogues are available.

TRUE-TO-SCALE SERVICES

9 Lodge Road, Bromley, Kent, BR1 3ND

Tel: 01 460 8126

This company offers accurate scale drawings of the last American Steam locomotives, showing g/a and all components, and taken from the original works drawings. These were the giants; 4-8-4's hauling 1,000 ton passenger trains up to 100 mph. For the hardware, Amrail imports a whole range of 5 and 7 1/4 gear bogies, couplers, headlights, bells etc.

TURRET ENGINEERING LTD.

Pindar Road, Hoddesdon, Herts, EN11 0BZ

Tel: 0992 461878

The Amolco milling attachment together with a table unit to form a complete machine tool is now available from this company or one of their regional distributors.

TURTON ENGINEERING LTD.

Moor Lane, Wotton, Birmingham, B6 7HH

Tel: 021 356 4777

Manufacturers of the useful 'Crab Clamp'.

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Tel: 0272 277427

Can reduce or enlarge your plans, or part plans, to the exact size required for the next project.

VIOLA PLASTICS

35 Croft Road, Hastings TN13 3HE

Drawings and drafting equipment available including a desk top range.

PAUL WAINWRIGHT

Hayford Way, Staveley, Derbyshire, S43 3JR

Tel: 0246 413115

Castings supplied for 3 and 6 in Allchin traction engines, rolling stock components and drawings.

WALSALL MODEL INDUSTRIES

Unit 3, 21-24 Hatherton Street, Walsall, West

Midlands, WS4 2LA

Tel: 0922 33718

Suppliers of a large range of wheel castings, finished wheels, axles, and other components for gauges 0 and 1. A particular feature are the square ended driving axles which give automatic quartering and easy removal of driving wheels.

WARNERS MACHINERY CENTRE

Unit 10, Finedon Road, Irthlingborough, Northants

Tel: 0933 651296

Stockist of secondhand machinery for the woodworker as well as the model engineer. There is always a good choice of lathes, milling machines etc available.

WATCO LOCO WORKS

PO Box 125, Como, West Australia

Specialising in a model 7 1/4 in locomotive of an American 2-4-0 design which it is claimed is designed particularly with ease of construction in mind.

H.S. WALSH & SONS LTD.

243 Beckenham Road, Beckenham, Kent, BR3 4TS

Tel: 01 778 7061

Suppliers of horological and general model engineering machines, tools and sundries, a giant (320 pages) catalogue is available.

WERNER WIGGERS

Am Weibbusch 1, D-4152, Kemper 1, West Germany
Tel: 021152 51484

WEXLER MACHINE TOOLS

Wellspring Farmhouse, Southrepps, Norwich NR11 8XA
Tel: 026 379 480

Suppliers of the popular Simat 101 lathe and its associated spare parts and accessories.

J.M. WILD

12 Norton Green Close, Sheffield, S8 8BP

Tel: 0742 745693

This company's catalogue includes all manner of general tools suitable for model engineering and clock making, including lathe overhead drive unit, lathe milling spindle, division plates, lathe overhead drive unit, filing rest, finer plate clamps measuring and hand tools.

E & J WINTER

PO Box 126, Welland, 2287 NSW, Australia

Mainly supplying their own drawings and castings for Australian prototype locomotives, the firm also stock a large range of other goods of interest to the model engineer as well.

COLIN WALTON CLOCKS

Tunbeck Cottage, Alburgh, Harleston, Norfolk

Tel: Homefield 616

Clock parts and tools. The range of products includes a radius turning attachment, and a depth tool. Plus many other clock specialities.

J. D. WOODWARD

6 The Narrows, Hincley, Leics LE10 1EH

Tel: 0455 613432

Suppliers of the 'Diamond' heavy duty fret saw and accessories.

WORKING PRECISION MODELS

10 New Street, Oundle, Peterborough, PE8 4EA

Tel: 0832 72868

Suppliers of drawings, castings, materials for 11 designs of internal combustion engines and workshop equipment. Engines range from 0.8cc diesel to a 30cc 4 cylinder overhead camshaft and workshop equipment includes Potts milling attachments, vertical milling machine, boring heads, drilling machine etc.

WARREN MACHINE TOOLS

Middle Street, Shere, Guildford, Surrey, GU5 9HF

Tel: 048 641 3434

Also at

Adlington Court, Aisley Industrial Estate,

Birchwood, Warrington WA3 5PL

Tel: 0925 821616

Under the well known name of WARCO the firm stocks a very wide range of machines of all sizes and types. The range goes through milling machines, lathes, drilling machines, grinders, power saws etc. They have woodworking machinery as well. Of particular interest to modellers are their drilling machines and their 918 model engineer lathe as well as the popular range of drill mills. Also the firm stocks the Japanese Toyo range of machines which are proving popular with modellers.

K.R. WHISTON LTD.

New Mills, Stockport SK12 4PT

Tel: 0663 42028

The famous Whiston 'Cat' (their 46 page catalogue) covers literally thousands of bargains embracing mechanical and electrical items, materials, fastenings, etc.

WHITING MACHINE TOOLS

Unit 10, Moorbridge Road, Bingham Industrial

Estate, Bingham, Nottingham, NG13 866

Tel: 0949 39114

Stockists of a very wide range of lathes and other machinery both new and second hand. In particular they specialise in the Myford range. All second hand machines sold by them are thoroughly renovated. They will also renovate customers' own Myford lathes. A large number of machines are always kept in stock.

YALANGA PTY LTD.

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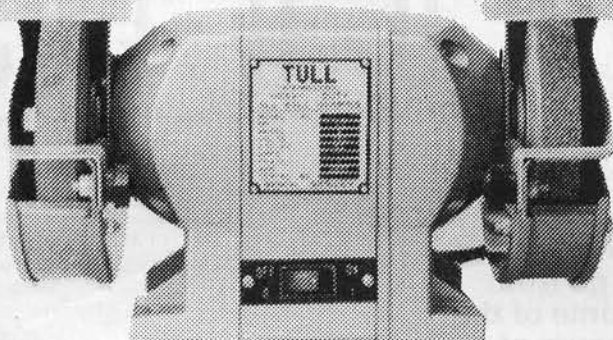
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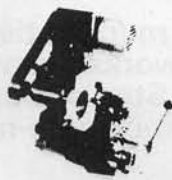


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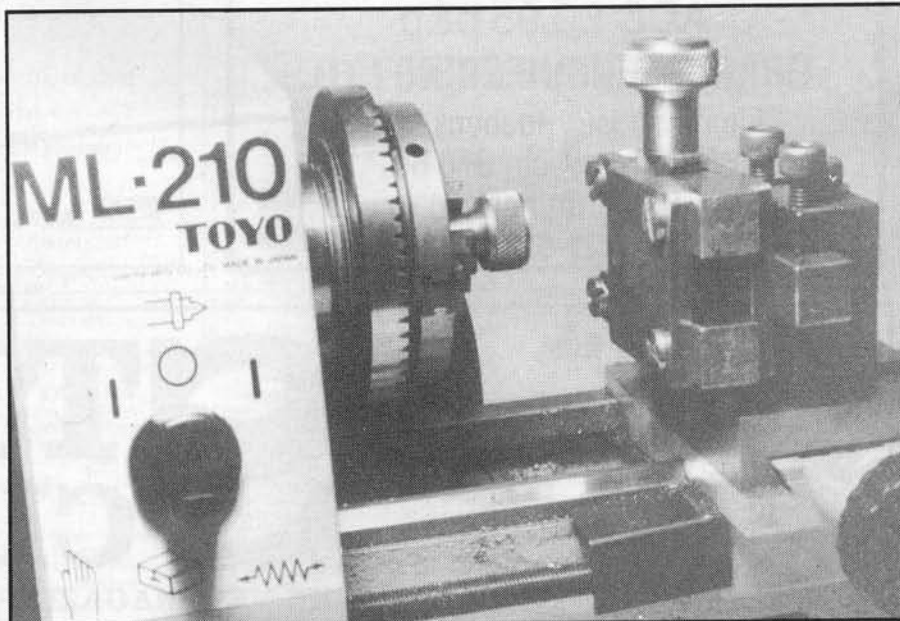
MAKING SMALL TOOLS

Many model engineers get as much satisfaction from the making of equipment for the workshop as they do from actually making models. Here Stan discusses some of the important factors involved in the home-manufacture of small tools

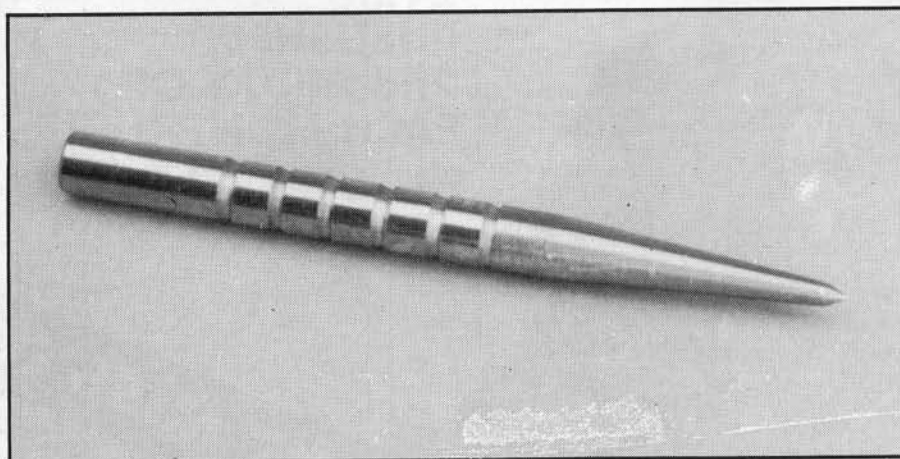
Many of those who have a workshop as their means of relaxation are quite happy to make tools and are justly proud of the standard of what they make. For one reason or another they do not have any interest in making models but toolmaking gives them great pleasure. There are also many who like making models but also enjoy making equipment for the workshop. I am referring here mainly to big projects involving many hours of work.

This sort of work is not everyone's cup of tea but anyone indulging in model engineering as a hobby should be able to make simple tools of the type that take only half an hour or so to do. Usually such tools are made because the item needed cannot be readily purchased, or, as in my own case, because by the time I have got in the car and driven to the nearest tool stockist I can make the thing for myself! A small stock therefore of tool steel of one type or another should always be kept.

There are two main types of tool steel with which we are likely to concern ourselves; the first is silver steel. This is available in round bars in both imperial and metric sizes. It comes, rather oddly, in lengths of thirteen inches and can be



A knurling tool like the one illustrated in use above on this Toyo lathe is not too difficult to make and always useful.



Picture at top of page shows a riveting tool for $\frac{1}{64}$ " rivets. Above, a small centre-punch; the grooves provide as sound a grip on the tool as knurling yet are a lot simpler to make.

purchased quite cheaply at most tool stockists. It is used for toolmaking because of its high carbon content which enables it to be heat treated successfully. Because of the carbon content it is somewhat harder to work with than normal mild steel, but it is still not difficult. In recent years it has become available in a free-cutting variety. This is more expensive than normal silver steel but if a great deal of machining is to be done on it, it may be worth the extra cost.

The other type of steel is known as 'gauge plate' and comes in flat strips of varying thickness. It is similar in working properties to ordinary silver steel and, like that, can be heat treated if required.

These steels can be used for making a variety of small tools such as special punches, reamers, 'D' bits, etc. Frequently a particularly long tool or one with an exceptional taper may be needed to fit in a confined space and this is where home-

made tools come into their own. The tool under construction should be machined or filed to shape and then hardened and tempered with the cutting edge, if there is one, honed to a fine finish after tempering.

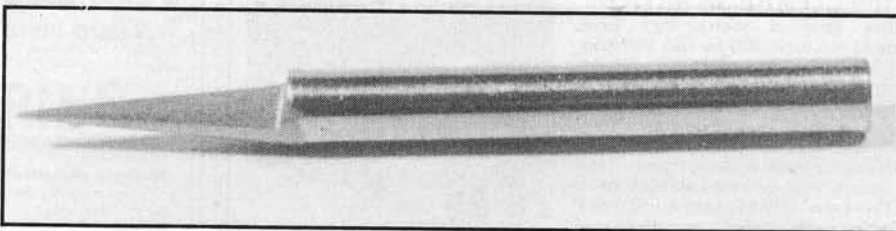
Both types of steel are treated similarly as far as hardening and tempering is concerned except that whilst silver steel can be quenched in water, gauge plate must be done in oil. It is also beneficial, if possible, to quench silver steel in oil as this makes it less brittle.

Hardening simply consists of heating the steel until it is the colour of a boiled carrot and then quenching it. It will be discoloured and, in order to temper it, it must be brought back to its bright colour by cleaning with emery paper. The discolouration can be offset to some degree if before heating the steel it is covered in washing-up liquid. Whilst there will still be some blackening this is much easier to remove.

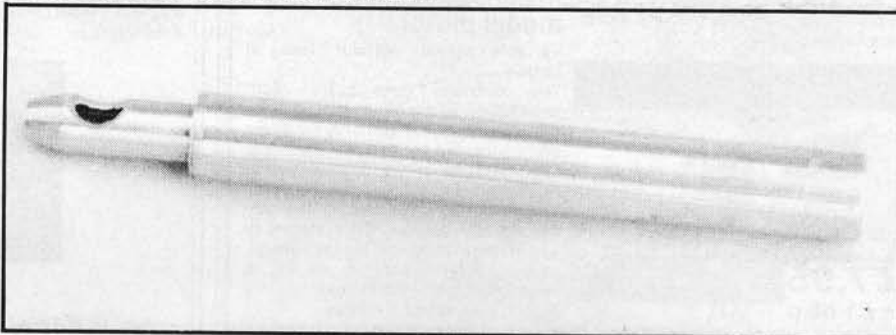
Once the steel has been hardened it should be tempered. This is to prevent it being too brittle when in use. The harder the work the tool will have to do, the harder the tool will need to be and so we temper the steel to different colours according to what the tool is required for. There are two ways of tempering the work. One is by an overall heating of the metal and then quenching it, the other by allowing the colour to run to the cutting edge.

I should explain why it is best to quench the steel in oil rather than in water. When high carbon steels are heated the carbon structure changes and if rapid cooling takes place one of the constituents becomes a substance called Martensite. This occurs when the steel reaches about three hundred degrees centigrade rapidly from around seven hundred degrees which is our boiled carrot colour. The steel also suffers from both expansion and contraction at around these stages. If the metal could be cooled rapidly right through there would be no problem but actually the outside cools first, the coldness taking time to get to the centre. The outer part then suffers a rapid expansion and then contracts slightly before the centre and the result will be a cracking of the surface. As the oil acts slightly slower than water, cracking is less likely.

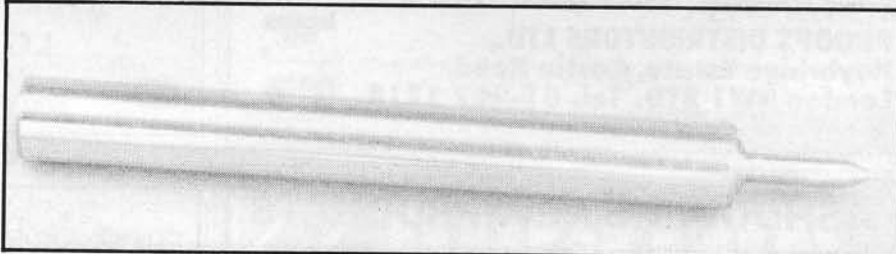
There is another effect from this expansion and contraction that is worth considering. Suppose, for example, we make a punch (and particularly if it is made to fit a hole and so the diameter is critical) and we heat the whole of the punch and then quench it on its side throughout its whole length in one operation. The side which strikes the coolant first will suffer the changes first and so some distortion will take place because the other side which has not yet been cooled does not react at the same time. In the case of a precision punch this could be critical, but with say a centre punch or screwdriver the distortion would make little difference. Even so, it is well worth giving a little thought when making tools to this effect, and to quenching the tool in such a way that the minimum distortion will occur and that it will occur in such a way that is not too



A small taper reamer like this one above is just one from a wide range of small tools that are quick and easy to make yourself.



And here's another. It's a tiny punch for making holes in gaskets – this one to clear 10BA studding.



... and another! This a special centre-punch for spotting through holes in mating components.

serious. In most cases, but not all, this will involve quenching the cutting edge first.

For overall tempering the tool should be laid in a tin of very fine sand (the silver sand sold for gardening purposes is ideal). The sand is heated from below until the steel is seen to change to the required colour when it is removed and quenched. As the heat is retained it is sometimes a good idea to remove it from the sand a fraction before the correct colour is reached; by the time it is quenched it will be at the correct colour.

To allow the colour to run, the tool should be heated at the end away from the cutting edge. It will go to a pale straw, then dark straw, brown, purple and blue. These colours will also run towards the cutting

edge in that order. The metal should be quenched when the cutting edge is at the desired colour. Tempering this way means that we may need a tool to be light straw at the tip; it could well be, however, that it is blue at the end furthest away from there. This means that we have a softer section for holding it than we do for the cutting edge. In most cases this is no disadvantage and the process is quite satisfactory. If for any reason the softer part will impair the tool's efficiency then the sand bath method must be adopted.

The chart included below gives the colour and temperature range for the tempering of small tools and reference should be made to it when making them.

TEMPERING COLOURS CHART

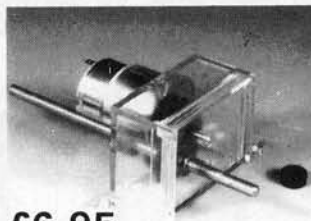
COLOUR OF METAL	PURPOSE
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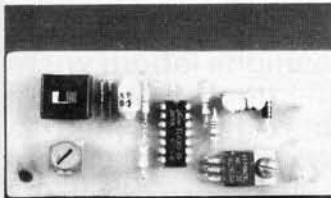


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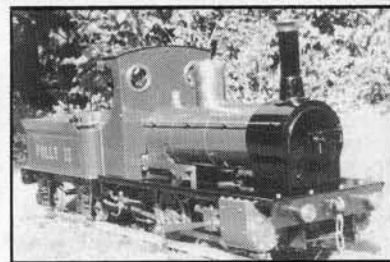
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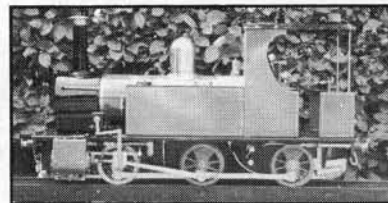
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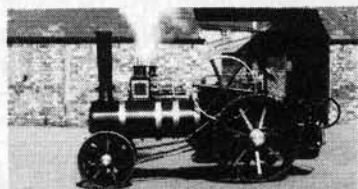
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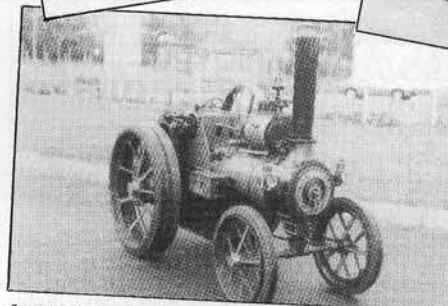
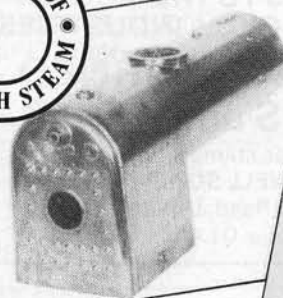
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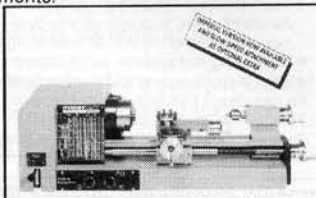


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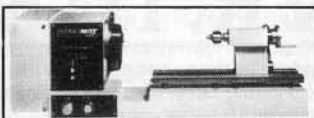
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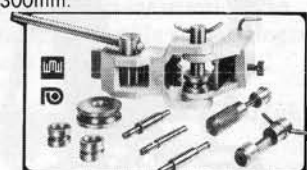
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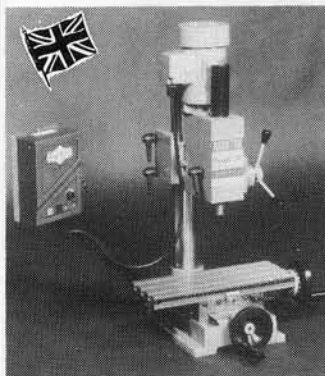
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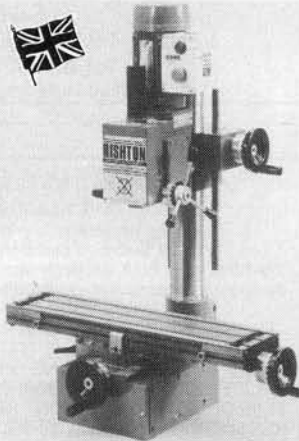
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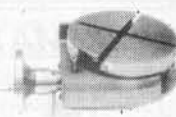
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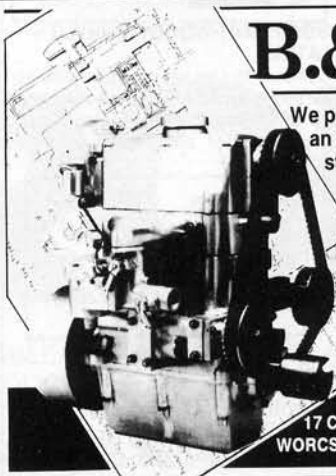
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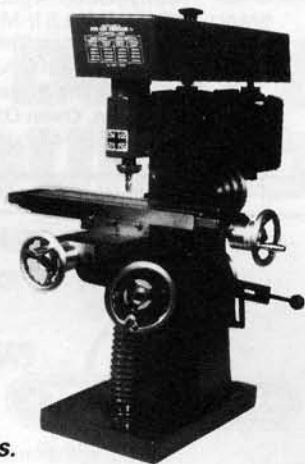
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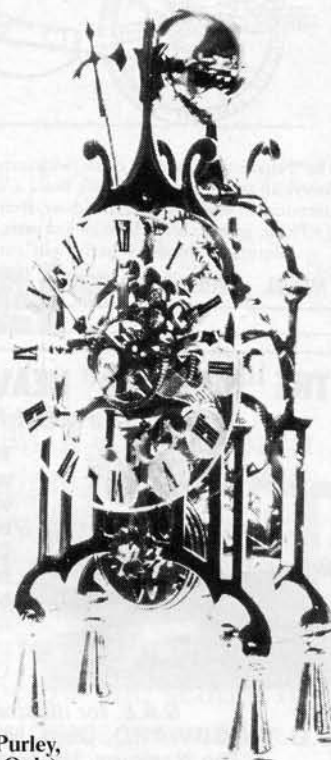
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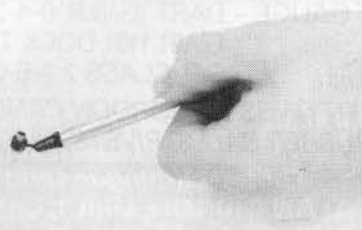
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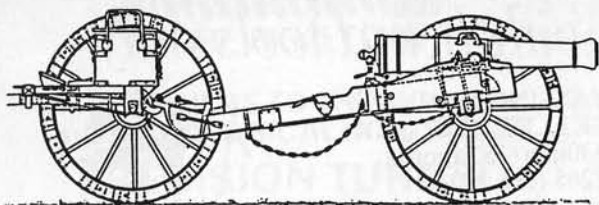
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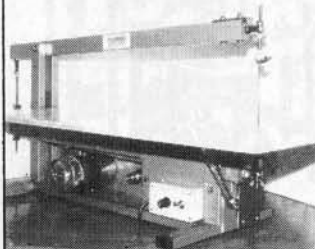


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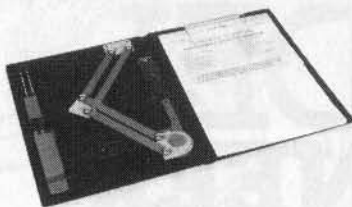
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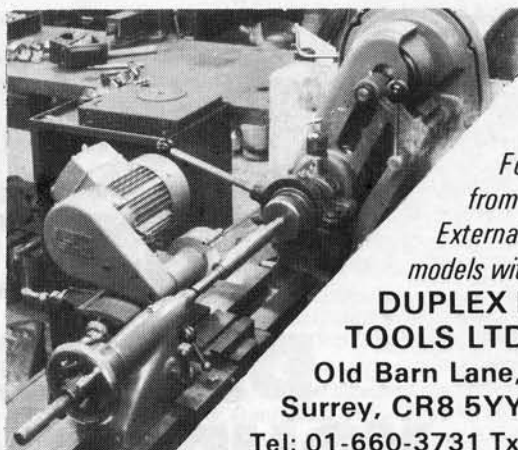
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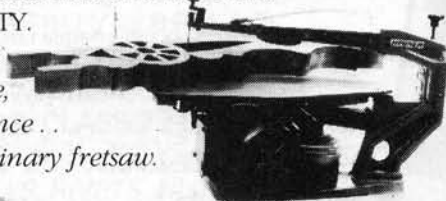


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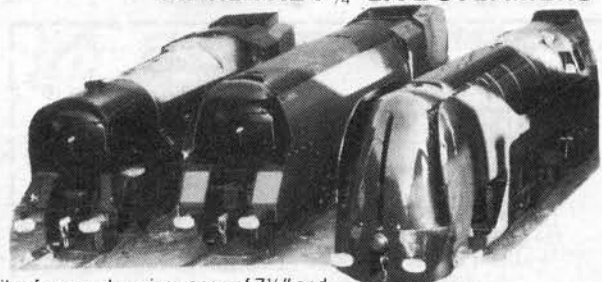
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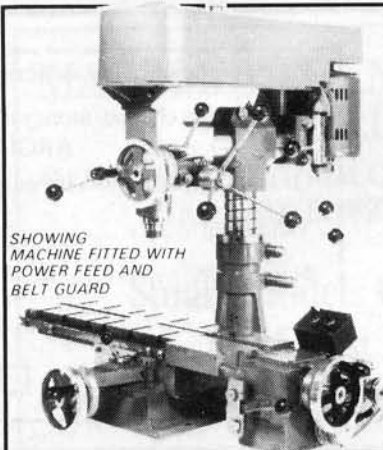


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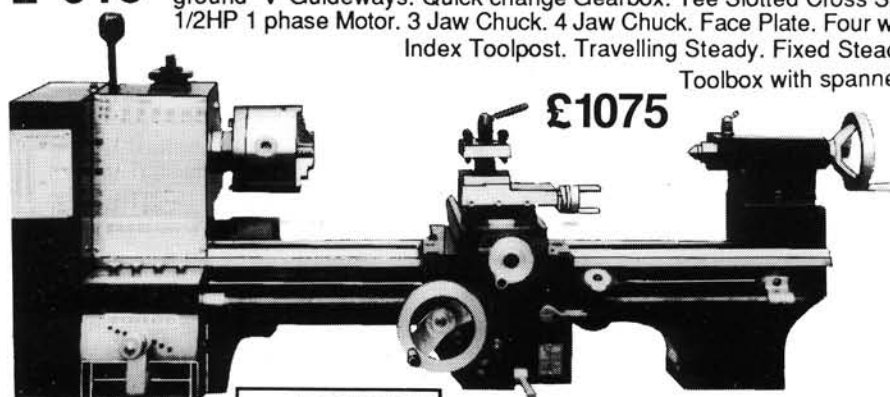
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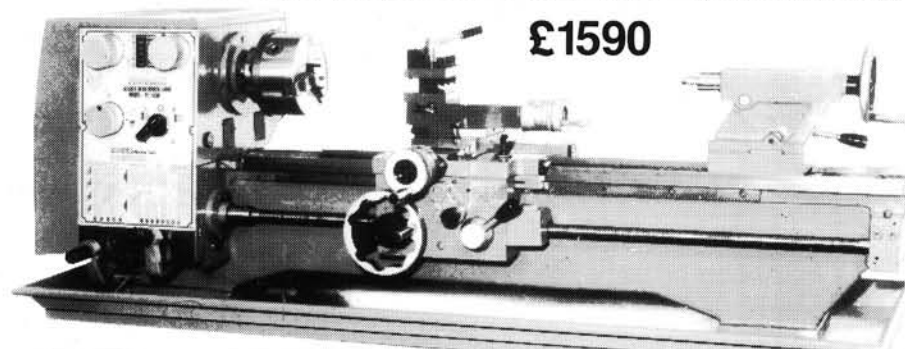
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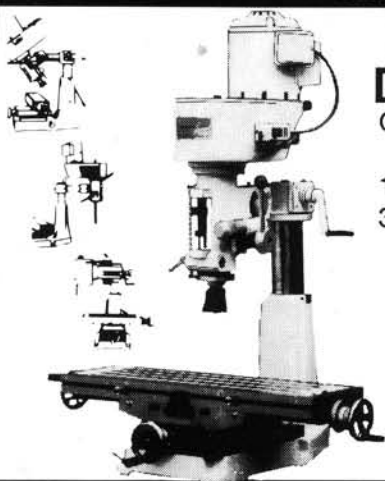
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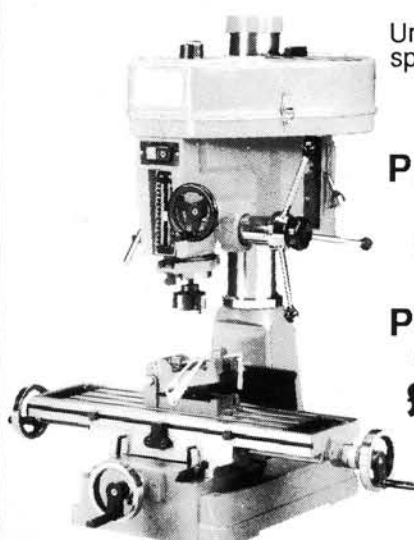


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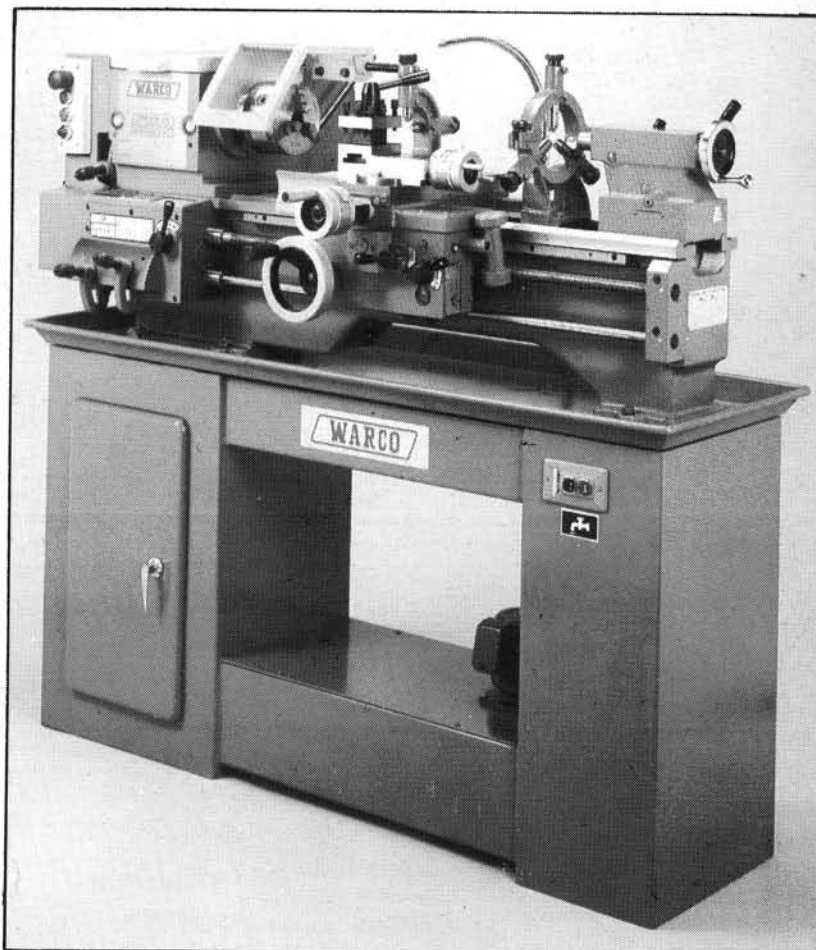
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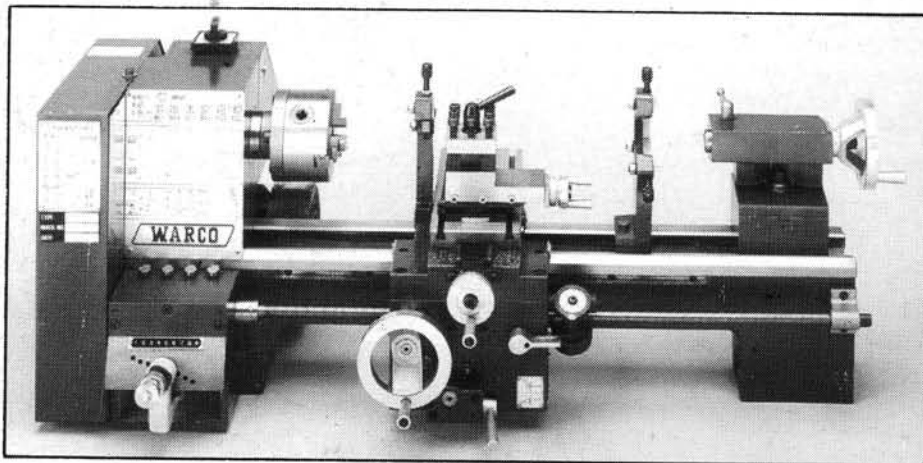
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918 MODEL ENGINEER LATHE



- 9" SWING
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