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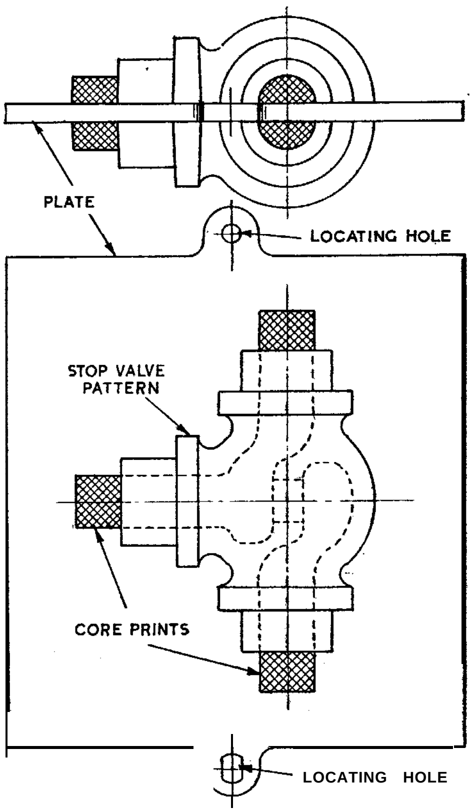
Elements of patternmaking

MANY MEANS-ONE END

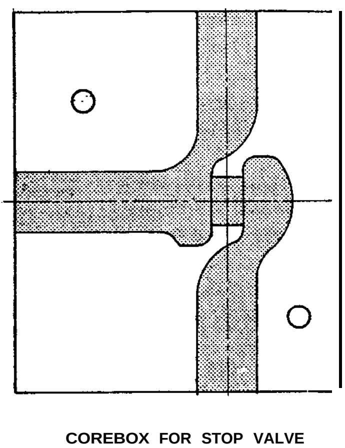
IN MOST PATTERNS the raw materials and the tools employed involve the skills of the joiner and cabinet maker, wood carver and turner. But in many respects pattemmaking is more or less specialised; the choice of timber is much narrower than in general woodwork, and the constructional methods, including the ways of making joints, often vary a good deal. Some of the tools and appliances are also of a special kind. In industry, machine tools, comparable to the milling and die-sinking machines used in metal work, have been developed.

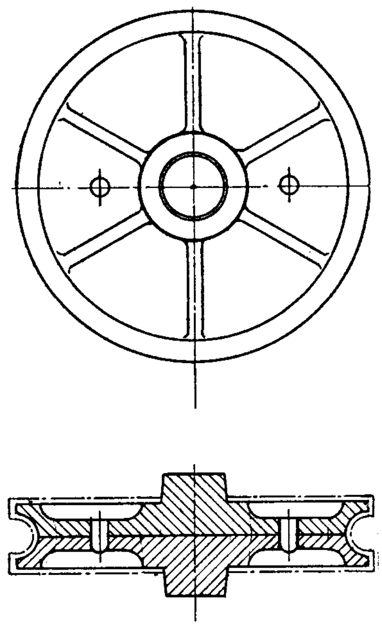
Text books on patternmaking quite rightly stress the importance of correct tools and methods. But amateurs, and model engineers in particular, are well used to obtaining their desired ends with very limited tools and unconventional methods. A full kit of special pattemmakers tools is very expensive (one textbook lists over 100 special tools as essential, and life is too short to learn how to manipulate every tool for both wood and metal to the very best advantage. I therefore do not propose to lay down the law on tools and methods, provided that they are capable of producing highquality workmanship. While I agree that the end does not always justify the means, I also contend that strict orthodoxy often cramps initiative and retards progress.

I know of one patternmaker instructor who recommends the use of a lathe for producing cylindrical work or discs and flanges, but condemns it for flat facing operations, and is even more averse to the use of a milling cutter for producing a groove or slot in a pattern. We must be consistent; if a worker in ceramics insists on purely hand work in pottery, he should go the whole hog and burn his potter's wheel! On the other hand, some of the special hand tools designed for pattemmaking appear to have a very limited use. I once bought a special corebox plane which worked on the Euclidean principle that "the angle within a semicircle is always a right angle." It is of little use for anything but plain circular cores, which usually do not need a corebox at all.



Below, Fig. 28: Pattern plate** for a stop valve, **and corebox** for **internal passages.
Right, Fig. 29: Pattern** for grooved **pulley; moulded in a three-part box





Many writers and instructors, in my opinion, make too much of conventional tools and technique and too little of pattern design, which I believe to be of first importance. I have seen beautiful patterns, made by skilled hands, to the best precepts of established practice-but they wouldn't come out of the mould ! Yet some less lovely examples, rough and ready like a ratcatcher's dog, have proved at least capable of being moulded. Neither extreme, of course, is good patternmaking; a combination of good design and skilled workmanship is always to be sought.

Some readers have asked about patterns for "plate" moulding, a process which is extensively used for repetition work, usually, though not necessarily, in connection with machine moulding. It may be said to bear a somewhat similar relation to hand moulding as stereotype does to hand-set letterpress: it eliminates individual handling of the patterns.

The plate may be of any convenient thickness so long as it is flat and smooth, and so long as it corresponds in size and outline to the moulding box, including the means of location of both halves of the box. One of the locating holes is round and the other is elongated, to prevent the boxes and the plate from being wrongly assembled; other methods are sometimes used, but the principle is the same.

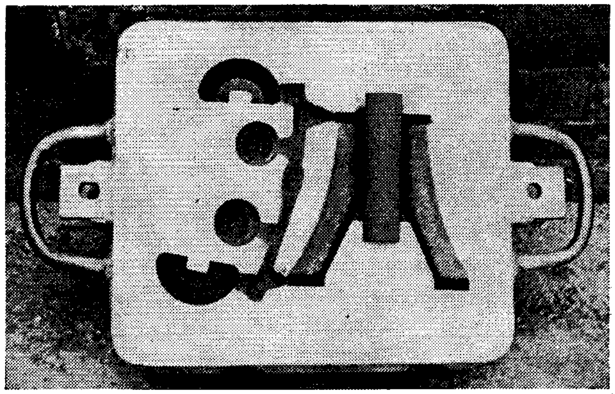
Split patterns are permanently attached to the plate (or cast integrally with it), half on each side, and exactly aligned with each other. If the pattern is recessed on one side, it may have to be sunk into or through the plate. By the sandwiching of the plate between the halves of the box, both of them can be filled and rammed, after which they are drawn away from the plate and assembled in the normal way for pouring the metal.

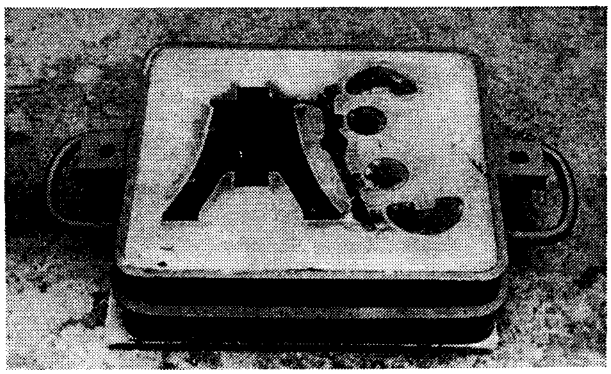
The example shown in Fig. 28 is a pattern for a stop valve attached to a plate for moulding. More often small patterns would be moulded in a group or spray, together with their connecting runners and risers, all attached to the plate. Coring, where necessary, is done in the usual way, with a sand core made in a corebox, such as the one illustrated for the stop valve.

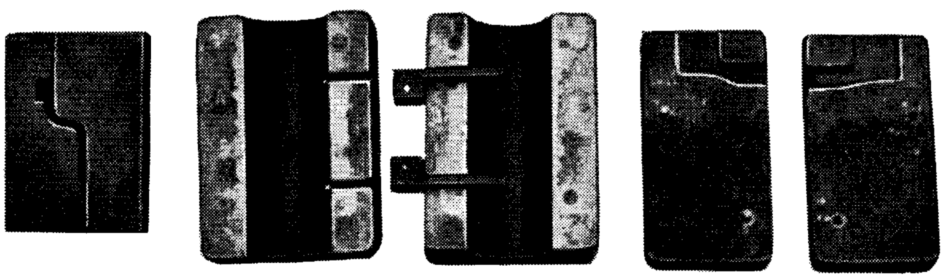
Another query refers to the use of a three-part box instead of a corebox for dealing with undercut patterns. An example is a grooved pulley which can only be moulded flat, because of recesses in the sides and possibly the ribs as well (Fig. 29). It could be dealt with by providing a core print all round the pulley centre, and using a corebox to produce an annular core. But an alternative, practicable only with the co-operation of the moulder, is to make the mould in three layers, interposing a narrow part, with a means of alignment, between the normal two halves of the box.

The pattern is split on the centre line of the groove, and dowelled or spigoted together. One half is placed on the moulding board, and the half-box is placed over it and filled and rammed. After the half-box has been inverted, the undercut part of the mould is cleared down to the level of the rim. The middle part of the box is placed in position, and also the other half of the pulley pattern. Then the second layer of the mould is made up to the level of the rim. The upper half-box is put on, and the mould for the top side of the pulley is moulded. When this part is lifted, the top half of the pattern can be removed; with the lifting of the middle layer, the other half can be dealt with similarly. The three parts of the moulding box are then assembled in the usual way for pouring the casting.

A need for this form of pulley casting would not often arise in model engineering. Except in fairly large pulleys, it would probably be easier to machine the groove from





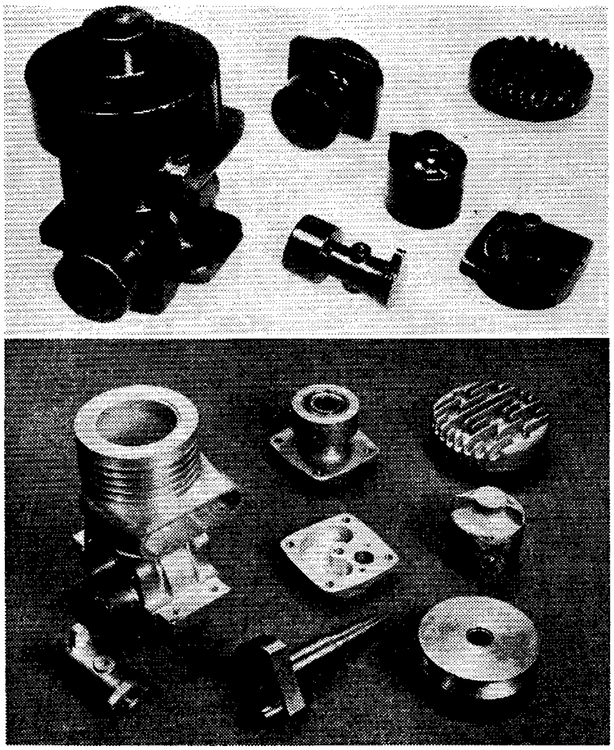


Above, top: Bottom half of plate-moulded box for the parts of a Stuart Turner 5A vertical steam engine, with trunk column core in position. Above: Top half of the box. Left: Coreboxes for the 5A cylinder, with the cast-in steam and exhaust passages

solid than to complicate the moulding. But if the groove was of a shape not easy to machine by straightforward means, such as for a chain pulley block, it might be worth while to adopt some such method.

One of the illustrations shows a good example of amateur patternmaking-the patterns for a racing two-stroke engine, together with the machined castings-made by Norman Hodges, of Blackheath MPBC. The set does not involve any very complicated design or constructional work, but it is typical of what many model engineers may encounter.

I recently visited the Henley-on-Thames works of Stuart Turner Limited, whose model castings have attained a world-wide reputation; it would not be too much to say that they have rarely been equalled, let alone



Set of patterns for two-stroke racing engine by Mr Norman Hodges, and the machined castings and parts

surpassed, for their accuracy and general quality. But ordinary patterns, of the kind discussed in these articles, are very little used in the Stuart Turner foundry, as nearly all their castings are produced in quantity, with metal plate patterns, machine moulded. Much use is also made of the shell moulding process : the moulds are made by coating the plates with resin-impregnated sand, and " curing " the sand at high temperature. The patterns must therefore be made in metal, preferably by being cast from the original individual patterns, in one piece with the plate; any fabrication or attachment needed must be done by brazing or welding. The plates themselves are not very photogenic; they look more like bas-relief sculpture or contour maps than anything else, but I have shown examples of moulds made from the plates in orthodox boxes.

We carmot understand how to design patterns without a sound basic knowledge of the work involved in moulding; and ***vice versa.***

Pattern construction does not necessarily follow a rigid set of rules; the very diversity in the shape of the castings to be produced calls for flexibility in structural planning. As I was once told, the methods used are as numerous as the holds in all-in wrestling. Sometimes patterns are made entirely in one solid piece, or from major component parts pre-fabricated, with the final shape obtained mainly or entirely by carving. At other times it is more convenient to build them up from a number of pre-shaped parts, fitted together and glued, and nailed or screwed, so that little or no subsequent shaping is necessary. Some professional patternmakers carry the carving technique to its logical conclusion, by forming ribs, bosses, fillets and other details from the parent timber. This calls for skill in the use of edged tools, but it is not always the best method, as the details may be somewhat fragile, owing to the direction of the grain of the wood. Built-on details, properly fitted, located and secured, often give a much. stronger and more durable pattern. Elaborate woodwork joints, such as those used in high-class structural joinery or cabinet making, are rarely needed in patternmaking, but a correct joint may provide the maximum strength and combat any tendency of the wood to warp.

In my own patternmaking I generally prefer to use a built-up structure rather than to carve from solid, except for the very simplest shapes. This may be, in a way, an admission that my skill of hand is not equal to carving from solid. I find it much easier to produce correct shapes in the conjunction of straight and curved contours, for instance, by shaping them first and joining them together afterwards. Many readers, I imagine, will find it convenient to adopt similar measures, but there are no right or wrong methods-only those which do or do not produce satisfactory results.

EDGAR T. WESTBURY.

**** To be continued***

Enough scribers for a thousand years !

I have read in ME several recipes for scribers made from gramophone needles. All miss the point (no pun intended) that seems to me the most important-the speedy renewal of the scriber without recourse to solder or extreme pressure.

When I first took to model engineering about 40 years ago. I made a scriber which I use today. Readers may be interested in my method of making the holder.

Take a piece of I/4 in. AF hexagon mild steel about 4 in. long, turn the corners off one end for an inch, and screw i/4 in. BSF for 3/4 in. Taper the end for about 5/I6 in. at an angle of about 20 deg. included, to a nose diameter of 5/32 in. Centre and drill the end I/I6 in. for a depth of 3/4 in., and carefully slit the piece into four for a length of 3/4 in. Use a I/32 in. slitting saw in the lathe, or an Eclipse Junior.

Get a piece of 3/8 in. dia. brass, centre it. drill it 5/32 in. for I/2 in. or so open up with a No. 6 drill for 5/16 in. depth, and tap I/4 in. BSF. Knurl the outside and part off about 7/16 in. long. Wrap the work with paper. reverse it in the chuck, and turn the nose taper at about 40 deg. or so to an end diameter of about 7/32 in.

Insert your needle, tighten the nut with your tinger and thumb, and you have a small pin chuck capable of holding needles from 0.030 in. to 0.060 in. with equal ease. You can also form your needles into small screwdrivers, gravers, and points for all sorts of marking, scratching, and probing. I have enough gramophone needles in my stock to last me 1,000 years at least !

ROBERT L. BELL.