ELEMENTS OF PATTERNMAKING

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GET A GOOD FINISH

By Edgar T. Westbury

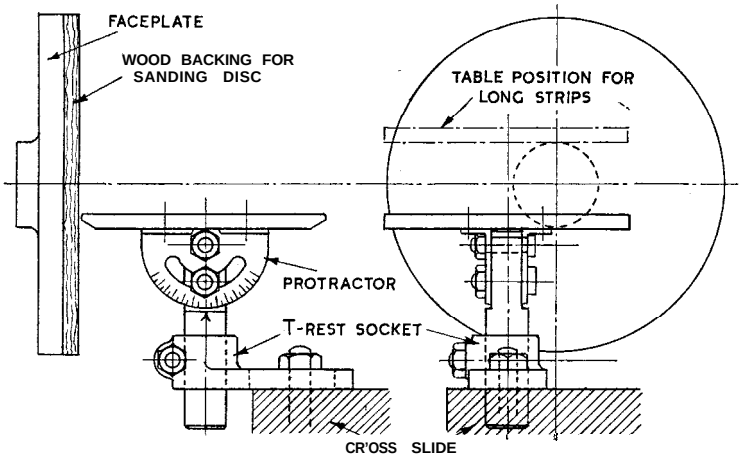
PATTERNS often have to be marked with numbers or lettering for identification. If the marks are not required to be shown on the casting, they may be painted or stencilled on the pattern, but chalked or pencilled marks are not permanent enough, as they may become partly erased or obliterated in the foundry. Marks which must appear on the casting may be produced in various ways; they may be carved or incised on the pattern to produce sunken or intaglio impressions. This method may be open to objection for highly-stressed components because of local reduction of thickness, resulting in weakening of the casting. Relief figures or letters are generally preferred, and are usually produced by the application of stock characters in metal or plastics to the surface of the pattern.

For small castings, the characters known as "sharp faced Gothic," the limbs of which are of V section and all equal in thickness, are generally most suitable. They are obtainable in sizes from 3/32 in. upwards, for plain figures and letters, and from 3/16 in. for fractions. In larger sizes, flat faced Roman and block characters can be had, together with various standard marks and symbols such as arrows. Most of them are die cast in white metal, and are attached by being cemented to the pattern. Some of the larger sizes, in brass, have spikes at the back, or are embossed from small plates of thin sheet metal and provided with holes for pinning.

Up to a few years ago shellac was usually employed for cementing letters to patterns. The results were satisfactory, though by no means perfect. Sometimes letters became detached and lost in the foundry. There are now better adhesives with a more positive affinity to metal, such as Araldite. Nevertheless, it is a sound policy, especially for patterns likely to be used repeatedly, to make up a small nameplate by cementing the letters to a strip of metal or wood, and take a plaster casting in type metal from it. The nameplate can then be sunk into the surface of the pattern and firmly secured by pins, in addition to cement.

Whether the markings are sunk or in relief, it is obvious that they can be applied to a pattern only in a position more or less parallel to the parting line, so that they will draw easily from the mould. If they have to be on a side face, a loose piece or a corebox must be provided to carry the nameplate. This is common practice in large work, but is by no means easy to carry out effectively when the work is small.

The importance of really good finish on all kinds of patterns cannot be over-emphasised. Wooden patterns, by their very nature, often present problems, as the grain interferes with cutting action of the tools and produces roughness. This is most pronounced in the softer varieties of timber, and on the end grain. Its effect is all the more troublesome because side surfaces of patterns, at right angles to the parting line, often present the end gram of the wood.



Above: Examples of sharp faced Gothic metal letters in various sizes. (From ***John Burn catalogue, p. 4)***

Left: Sanding disc and adjustable work rest for use in the lathe

Much can be done to. avoid roughness by the use of really sharp cutting tools, and the selection of close-grained timber, whether soft or hard. In turned work, it is sometimes impossible to avoid roughness where the cut must necessarily oppose the grain no matter how sharp a turning tool is used, the finish may not be as good as was desired. It helps to run the lathe as fast as possible for all wood turning operations, when the ubiquitous metal turning lathe has to be used, the speeds are not usually high enough for small pattern work. I have found it necessary to provide special high-speed driving pulleys on the motor and countershaft, and to make sure that the mandrel bearings are kept well lubricated, to cope with speeds higher than those for which they were designed. For turning a wood pattern 1 in. diameter, at least 3,000 r.p.m. can be used, with still higher speeds for routing, milling or drilling. The technique of the wood turner, in presenting the tool obliquely at a tangent to the surface for a shaving cut, is very effective for parallel turning, but cannot be used in the region of changing contours, shoulders and fillets.

However much care we take in cutting, patterns cannot often be finished directly from the cutting tools, and some form of abrasive finishing is nearly always needed. Glasspaper in varying grades is very effective, but must be used with discretion, as it can mar finish as easily as it can produce it, and can often impair accuracy or produce a slovenly rounding-off of corners intended to be sharp and distinct. Often the very places which ***most*** need smoothing-the hollows, interstices and recesses-cannot be reached at all by abrasives.

I prefer to apply abrasive finish, when I can, to ***com-***ponents of fabricated patterns before they arc finally assembled, and ***to use*** such mechanical aids as may be readily arranged or improvised, to help in producing and maintaining the accuracy of finished surfaces. Sanding discs or bands, driven in the lathe or by some other convenient means, are very useful, particularly if they are provided with a way of adjusting and controlling the angle at which the work is presented to them. But free-hand methods, such as rigid or flexible sanding discs driven by electric hand drills, need more skill to control them than is commonly realised. They can slur off a corner, or gouge out a hollow, in the twinkling of an eye, if they are operated by careless or unskilful hands.

A wooden facing about 7 or 8 inches in diameter, screwed to the lathe faceplate and trued up in position, with a sheet of glasspaper cemented to it, will serve as a precision sanding disc capable of generating surface or angular accuracy. The grade of abrasive will of course depend on the amount of material to be removed and the degree of finish required; a medium grade of glass, flint or garnet paper will deal with most requirements. Excessively fast running speed is not an advantage, as it may tend to glaze or char the work, and the same applies if the abrasive becomes worn out or clogged. It is essential that the disc should run true for accurate work.

For flat surfaces, the work is simply applied face-on to the disc, with care to avoid tilting or uneven pressure, and is kept moving across the disc so that scoring does not occur. You can best deal with the edges by supporting the work on a flat surface large enough in area to give proper guidance. The saw table, which is obtainable as a lathe (accessory and is useful for many sawing, rebating and grooving operations in patternmaking) can be used as a sanding rest, mounted as close as possible to the face of the disc without touching. Most saw tables have some degree of vertical adjustment. For dealing with cross grain, they are best placed somewhat below centre level, on lengthwise grain, the above-centre position, allowing the work to be presented more or less tangentially to the disc, generally produces a better finish.

Some means of adjusting the angle of the sanding rest is very useful, but not many saw tables have this provision. A simple tilting table can be made to use the socket of the T-rest (when there is one) by providing a stalk of appropriate diameter, with a pivoted joint at the top to carry the flat table, capable of being adjusted and locked at various angles. To do the job thoroughly, an index or protractor may well be added to indicate the angle of tilt; even without this elaboration, the device will still be found useful.,

With proper control of the angle in sanding operations, you can get down to the minimum draught angle ***on*** patterns without the risk of trouble in withdrawing them from the sand. When pronounced taper ***or*** convexity cannot be allowed it may be reduced to bare one or two

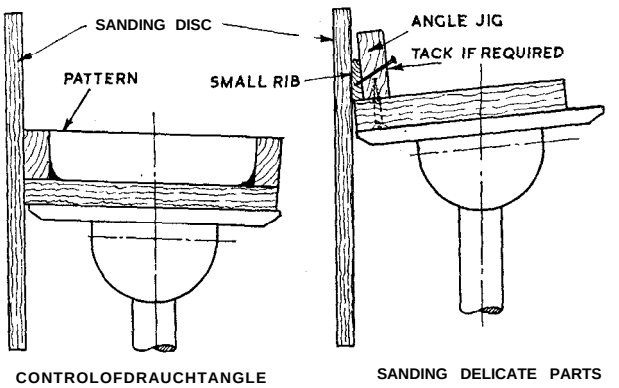
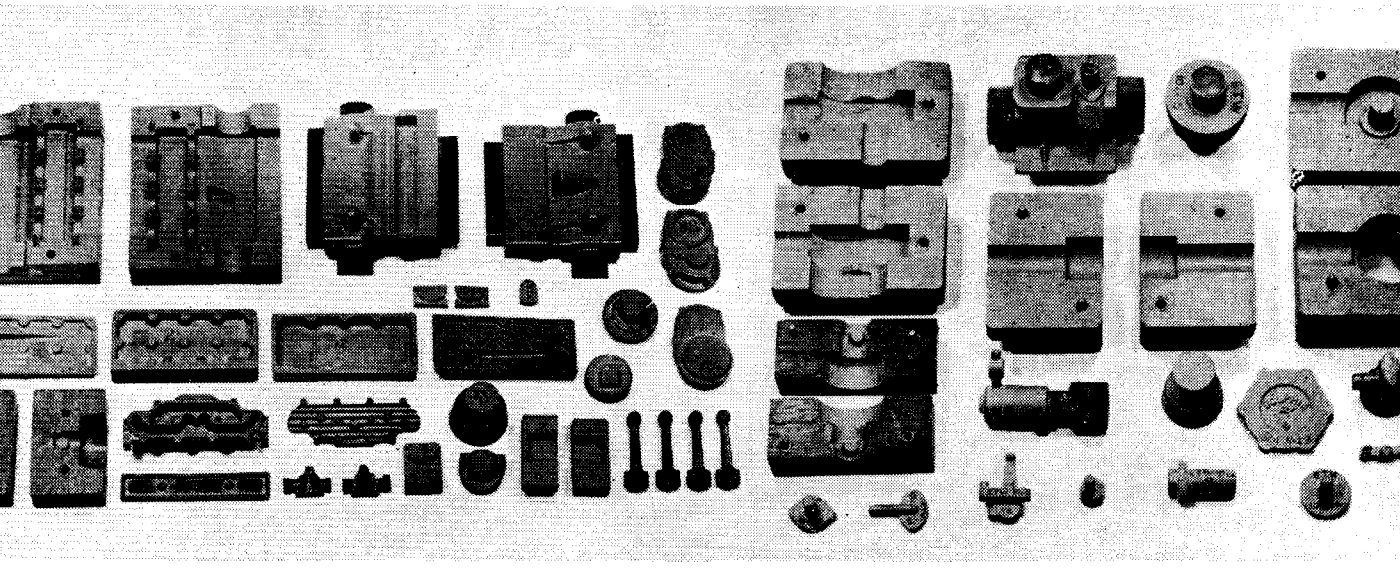


Fig. 44: ***Examples of operations to which controlled sanding can be applied***

degrees with accurate and dead smooth patterns. If the taper or convexity is less important, it is better to provide more liberal draught angle, up to five degrees or more. Many details of patterns which require draught, such as ribs, fins and the spokes of wheels, may well be pre-shaped and sanded before assembly.

Sanding of small parts which are delicate to handle may be found difficult, and may possibly involve risk of injury to the fingers. Abraded finger-tips are only too easy to acquire-and they are painful, and slow to heal. To hold and control small parts, it is worth while to improvise simple jigs in which they may be inserted or tacked in position. For the hand sanding of small pieces, you may use a sheet of glasspaper laid on a flat surface, and rub the work in contact with it. A sheet or pad of soft rubber to press the work down on the paper will protect the finger-tips.

Abrasive operations should never be applied to timber until nearly all the cutting operations are completed;



Left: set of patterns for SEAL 15 C.C. 4-cylinder engine

Right: Set of patterns for DOLPHIN 10 c.c o.h.v. engine

otherwise abrasive particles embedded in the grain may play havoc with edged tools. Pm-shaped pieces may sometimes have to be cut to length after sanding, but this does not normally involve more than the use of a durable metal-cutting saw. Fine glasspaper or other abrasives are not usually required on patterns before they are painted, as it is often better to leave the wood with a slightly matt finish, or " tooth " as French polishers say, to key the filler or finishing medium.

The painting or varnishing of patterns is to be recommended, not only to improve the smoothness and appearance, but also to protect the surface against damage or abrasion in the foundry, and to prevent the absorption of damp. A properly applied paint coating may be harder and more durable than the timber itself. Paint should never be used to bodge up the surface of a roughly-made pattern, or its last state may be worse than its first. Wood fillers can be used to stop crevices and help to build up body on surfaces, but the less they are required the better. Any application of this kind should be quick drying. Casco wood stopper can be recommended; it can be obtained coloured to match various timbers, and it gives a hard surface which takes paint or varnish readily.

Any kind of paint or varnish can be used on patterns, so long as it provides the required finish and resistance to damp. But shellac-based preparations are universally favoured by patternmakers, as they dry very rapidly, and produce a hard glossy surface if they are thinly and evenly applied by brushing or spraying. They may be had either as a transparent varnish or as an opaque paint, usually black, red, orange or yellow, for the identification of pattern surfaces and core prints, or of the metals in which the castings are required.

The alcohol solvent used in shellac paints has a penetrating action and tends to swell the surface fibres of the timber, or to raise the grain, as woodworkers say. After applying the first one or two coats of paint, and allowing them to dry and harden properly, you will find that the surface has become somewhat roughened, and that the grain pattern has become visible in relief. A rubbing down with fine abrasive is necessary after each coat to restore smoothness, and should be repeated until the final coat is applied. By this treatment, the stability of the surface is assured, and any moisture which may penetrate the timber afterwards will not swell it or tend to lift the paint layer. The general technique of painting patterns follows that of the old school of coach painters, who believed in " putting on twenty coats and rubbing nineteen of them off;" the high finish seen on professional patterns is proof of the efficacy of these methods.

Shellac paints can be made up by dissolving flakes of orange or lemon shellac in industrial alcohol, and adding fine-ground powder pigments such as ochre or vegetable black. Methylated spirit, as sold for medicinal purposes, contains a certain proportion of castor oil or other substances which retard drying. Cellulose paints are sometimes used for patterns, though they are more suitable for metal (after an appropriate undercoating or primer has been applied) and for spraying rather than brushing. The solvents used in cellulose and some other synthetic paints will dissolve wax fillets and latex adhesives.

The pains taken in the design, construction and finish of patterns will be well repaid in the quality of the castings obtained from them. They will be easy and straightforward to mould, and will also set a standard that will encourage the conscientious moulder to produce work of which he can justly be proud.

All accessories for patternmaking, including paints, adhesives, pattern letters and figures, fillets and corebox fittings, are marketed by John Burn and Co. Ltd of Henshaw Road, Small Heath, Birmingham 10, and by engineers' supply dealers in most industrial towns. ❑