FOR THE SCHOOLS

Elements of patternmaking

Application of fillets

Continued from June I, page 84

METHODS of moulding, and the way in which the pattern is disposed in the mould, often influence the policy of construction. As an example, the pattern for a locomotive smokebox saddle shown in Fig. 30 can be moulded in two or possibly more ways to produce generally similar results, including the coring right through.

In A, a plain rectangular core is employed to simplify corebox construction, and the mould must be split on the cross centre line. This makes the side edges of the saddle flange in the pattern rather fragile, and both these and the side locating strips have a long draw; the necessary draught on the sides will cause the casting to be slightly convex. It will therefore be necessary to file or machine the surfaces which have to be bolted to the main frames.

A better form of pattern construction is shown at B. It calls for a somewhat more difficult corebox to produce the concave saddle flange, but it enables the mould to be parted on the longitudinal centre, conducive to cleaner moulding of side projections, and to much more robust pattern construction; the bolting surfaces can be cast flat enough to need little or no dressing. In either form the pattern could be made from solid or be built up, but in A it would be at least judicious to make the sides of the flange separately in durable timber with grain in the right direction.

Detail work on patterns can often be made more accurately by fabrication than by carving from solid. This applies particularly to bolting bosses or lugs projecting from otherwise regular surfaces. A circular boss on a flat surface may be produced by turning a disc from a piece of hardwood, parting it off, and gluing it down in correct location. Carving from solid would involve paring down the whole of the flat surface around the boss. Where the boss projects from a round surface, a flat disc cannot readily be applied and so it is best made in the form of a dowel which can be fitted to a drilled hole. In both instances the sides of the boss can be tapered or turned concave to form a fillet at the root, as shown in Fig. **31.**

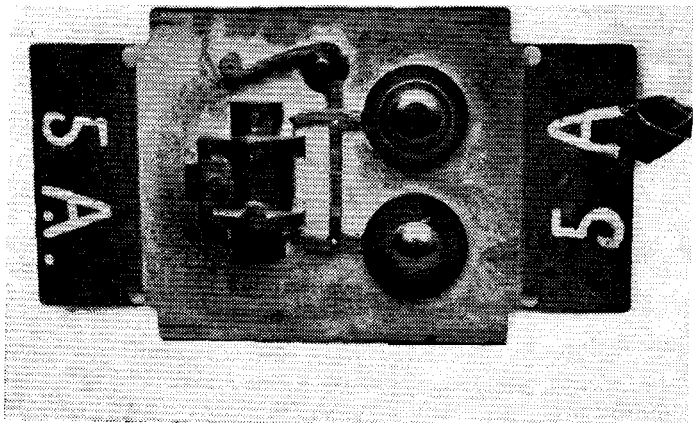
Where a bolting boss comes close against a shoulder, it is often difficult to obtain a clean circular impression in the mould, and it is often better to make the boss D-shaped to avoid this trouble. Various shapes of projecting surfaces, of course, can be applied in the same way; where bosses have to be symmetrical or concentric to other major parts of patterns, they may be located by extended spigots fitted to centre holes. Sometimes bosses may have to be split, for locating on the parting line of a pattern; this is not a good practice, as I have already explained, but it cannot always be avoided.

There are now many kinds of glues and adhesives for fabricating woodwork, but most patternmakers would agree that it is difficult to beat good quality Scotch glue, provided that it is freshly made and of the right consistency. Its major limitation, if such it can be called, is that it will not fill up spaces in badly made joints ! The parts of patterns must be properly fitted together, and any exudation of glue from joints must be cleaned away. If made-up glue must be used, one of the most reliable is Croid. The so-called "impact " adhesives will make quick joints, but they remain tacky for a long time, and when thoroughly hard are often brittle. Once the parts are in contact, these glues do not allow them to slide very readily if correct location is not immediately obtained. Small panel pins can be used to position the parts, or as a reinforcement to glued joints, though this should not be necessary. If it is not convenient to withdraw them after fixing is complete, the heads should be sunk well below the finished level of the surface with a fine pin-punch.

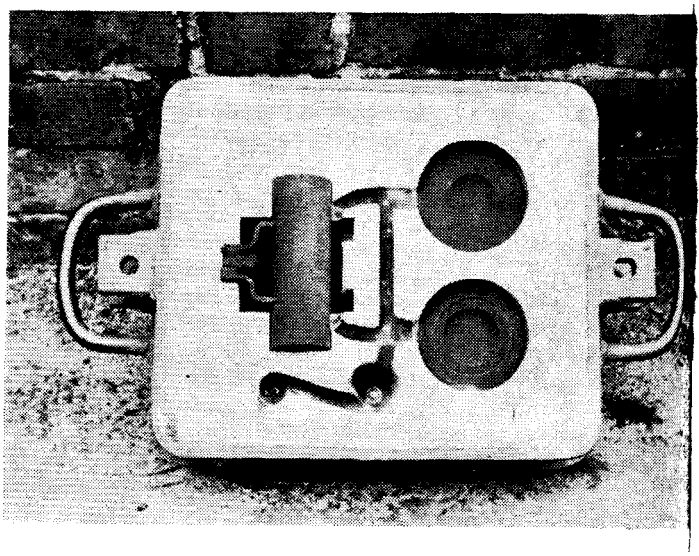
The importance of fillets in pattern work has already been emphasised. Ready-made fillet strip, in leather or plastics, and in various sixes, can be obtained from patternmaking supply dealers; it has a high degree of flexibility, and can be tacked in place, and glued into the corners of most straightforward work. If it is not easy to set, or if the shape of the work makes it difficult to apply, plastic material in mouldable form can be used. Ordinary glaziers' putty is sometimes employed. It can easily be moulded to form and smoothed off, but its disadvantages are that it takes a long time to harden properly, and does not adhere very readily to bare wood. As patterns are more often than not required in a hurry, it is not usually convenient to pre-paint them (with oil paint) and wait for the paint and putty to dry.

The material most commonly used by patternmakers for moulding fillets is paraffin wax, which can be applied with a warmed tool and sets very quickly. I knew one patternmaker who organised a collection of candle-ends for this purpose. Special fillet tools, in the form of a rod with a metal ball at one or both ends, are obtainable to suit fillets of various sizes, and are equally useful for pressing glued fillets into place. But I prefer to make fillet tools as required, by turning a ball on the end of a substantial piece of brass rod. This has more conductive merit than the regular fillet tools and holds heat longer. It needs to be fitted to a handle or insulating sleeve for comfortable handling. (Fig. 32.)

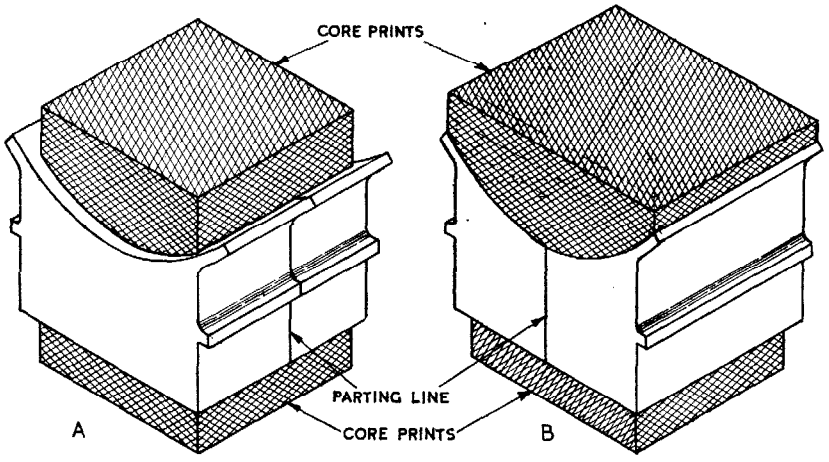
An example of a built-up pattern with applied fillets is shown in Fig. 33. Ready-made strip can be used for the fillets on the top and underside of the outer flange, but the small-radius curves of the top platform call for moulded fillets. If there is any choice in the wax used, ordinary paraffin wax, or candle-ends can be improved upon; the specially toughened wax used for dental impressions, Camauba, composite wax, or beeswax, have advantages. Sometimes plastic wood is used but it is difficult to smooth off nicely; it tends to stick to the tool and shrinks in hardening. Resinous compounds, such as Prouts' glue or the pitch-based material known as Chat-



Pattern plate for cylinder and cores of the Stuart gA engine



Bottom half of mould made from the plate, with main and passage cores in position



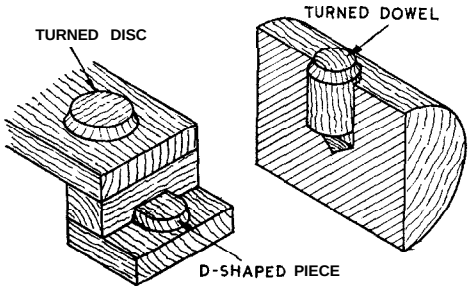
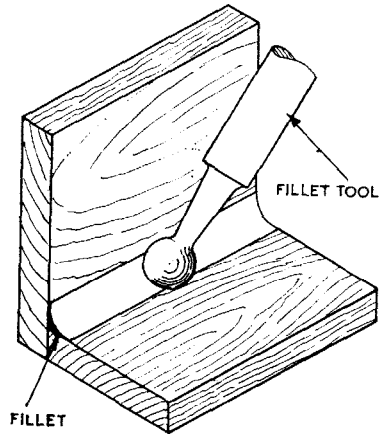


Fig. 31: *Bosses applied to fabricated patterns*

Left, Fig. 30: Patterns for a smokebox saddle



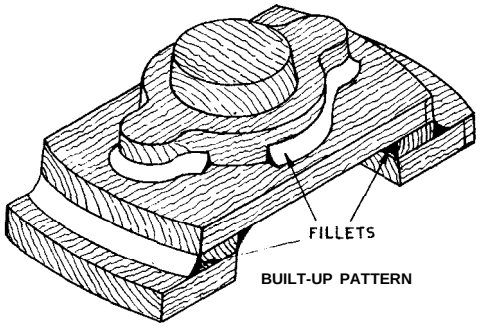
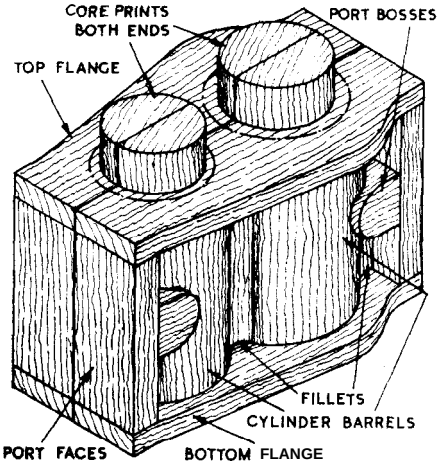


Fig. 33: Fillets applied to a fabricated pattern

Left, Fig. 32: How fillet tool is used to mould the Wax or strips into corners



Right, Fig. 34: Fabricated pattern for the cylinder block of **compound** *engine*

tertons' compound, can be melted and run into corners, where they tend to form a natural fillet in cooling, but they are better suited to metal or plastic patterns than to wood.

Multiple fabrication is employed in the pattern for a compound engine cylinder block in Fig. 34. The barrels of the two cylinders are turned, after the halves have been split and temporarily joined together; the core prints at both ends may well be integral with them. Top and bottom flanges, also split, are fretted out to embrace the core prints and locate the barrels. Straight pieces form the port faces at either end, and bosses are carved to shape and fitted to take the exhaust ports. The fillets between the barrels and port faces should be made of pre-shaped slips of wood, but wax fillets can be moulded into all other internal corners.

It will be seen that though a pattern of this kind would be quite satisfactory to all intents and purposes if if were made from solid, a good deal of skill would be required to carve it accurately in all its contours, and to obtain a high enough finish where the cut crosses the grain of the wood. The drawing does not show the necessary allowance for draught, by tapering the flanges and port faces away from the centre line, but this need only be very slight in a small pattern with relatively shallow depth.

External cores may be found necessary when it is impossible to avoid a pronounced undercut in a casting. An example is seen in the pattern for the body of the Whippet engine, which is shown in course of construction. It needs to have a flange overhanging on one side, for the attachment of the timing case, and in the normal way it could be drawn from the mould only by carrying this flange right back to the parting line. Apart from drastic alteration of the external shape of the casting, this would add a great deal of unnecessary metal and thereby increasing the weight.

To cope with the problem, a core print is added to the side of the pattern, and a corebox is made to fill in the space behind the flange. The photograph shows the halves of the pattern from both sides; the part to be cored out is shaded to distinguish it from the bare wood. Another corebox is, of course, required to form the interior of the crankcase, including the camshaft tunnel, and also the water jacket. The pattern itself is another example in which alternative methods of construction are practicable.

For some patterns, composite or laminar construction is a necessity for strength and resistance to distortion. Take the case of an air-cooled engine cylinder with a number of thin radiating fins. No matter which way the grain of the wood is disposed, the fins are bound to be fragile, but by building them up in layers from a close-grained hardwood such as beech, the highest posssible strength can be obtained. Fins should ***always*** be well tapered, with a fillet at the root, to simplify moulding and also to promote heat conduction. Parallel fins, with sharp comers at the root, may keep beautifully cool in themselves, but do not conduct heat away efficiently from the cylinder walls.

There is always some difficulty in getting clean castings with deep and closely-spaced fins: however excellent the pattern may be, the narrow ridges of sand in the mould are liable to break down with the weight of molten metal when the mould is poured. Sometimes the fins are produced by the use of a corebox with special core sand "bound " or reinforced by special oils or gums, and baked hard. The shell moulding method also enables fins and other fine details to be cast without risk. In quantity production, stripping plates are often used with finned patterns, to prevent collapse of the mould when the pattern is drawn.

Where it is possible to machine the fins of a small cylinder without any great difficulty, it is best to omit them from the pattern, or merely to indicate their position by rudimentary grooves. This applies also to cylinder heads, though here machining of the fins is often more difficult owing to irregular contours, and effective radiating surface is even more important than on the cylinder barrels.

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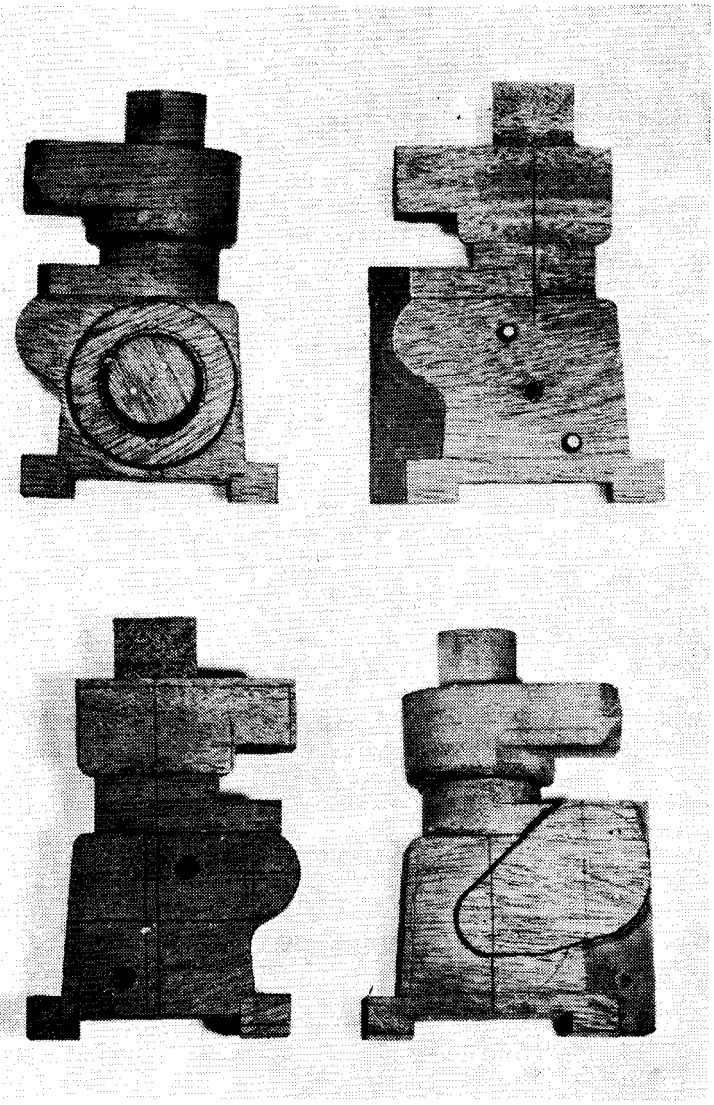

Top: Partly-made split pattern for Whippet engine body, with core print

Above: Split pattern from other side

**** To be continued***