By EDGAR T. WESTBURY

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Simple cores and core boxes

MOST amateur patternmakers tend to avoid any more complication in either the design or construction of patterns than is absolutely necessary.

Simplicity is always good when it achieves the required ends, but attempts to pursue it at all costs often result in a product which may serve its purpose, but falls short of ideal in many respects.

A casting which should be hollow is often moulded in a solid lump, and though it may be possible to drill and bore it, the wastage of metal and time may cancel out any saving.

Unnecessarily heavy sections are often difficult to cast,. especially if they are adjacent to light and delicate detail. which cools and solidifies relatively quickly. This results in the heavier sections contracting at a different rate, and may cause the formation of depressions, blow holes or cracks at the junction of different sections.

Uniformity of metal section, and avoidance of abrupt changes of thickness and contour, are always objects to be aimed for in the design of castings. In full-size practice, economy of metal alone dictates that castings should be no heavier in section than is necessary for adequate strength. Even when this is less important, it promotes good design and is much to be preferred to the shapeless and ill-proportioned lumps of metal which are sometimes graced by the name of castings. They may serve their purpose, but by no standards can they be considered good engineering.

Sharp internal comers in castings are always to be avoided. This is most important in ferrous metals, but it applies to some extent in other metals or alloys. An internal radius, or " fillet " as it is usually called, should be provided in all corners.

There are three sound practical reasons for this: first, it promotes strength in the angle through a natural grain flow, and by providing the equivalent of a small strut to stiffen the junction; second, it avoids the tendency to the formation of cracks, either in the initial cooling of the casting, or its subsequent use as a stressed member under either live or dead load; third, it helps the moulder to produce a good casting, because rounded corners have more stability and are less likely to be damaged, or washed away by molten metal, than sharp corners in friable sand.

In the parts of patterns which can be turned in the lathe, it is quite easy to provide fillets by the use of a radius tool or gouge. With patterns carved from the solid, it may be a little more difficult, but by no means impossible, to produce ***them.*** Built-up patterns may have sharp internal corners, but fillets can be added in several ways, and I shall deal with them later when describing constructional methods.

Cores, especially if they require special coreboxes, are sometimes regarded as a nuisance in small castings. It is true that they make more work for the patternmaker and the moulder, and if they are very small and intricate, the chances of success with them may be limited. But the important consideration, in deciding whether to use cores, is the ability to improve the quality of the casting in any way, or to reduce the problems or quantity of machining.

It has already been explained that plain cylindrical cores in certain sizes can be supplied by the moulder, and do not call for special coreboxes. They will meet the needs of the majority of model engineering castings, and even when not, ideal for particular purposes, a tolerable compromse, involving a little more

FOR THE SCHOOLS

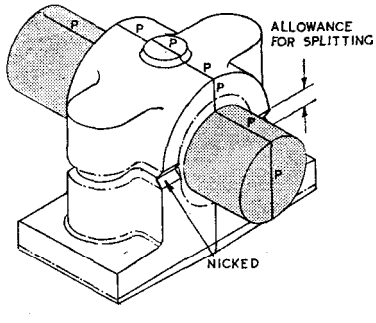


Fig. 12: ***Pattern for split plummer block, with prints for a plain core***

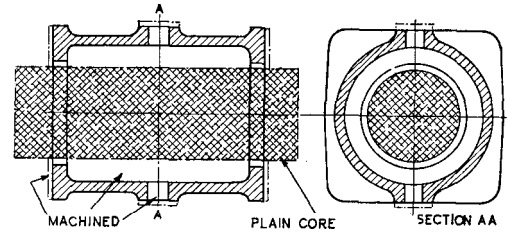


Fig. 13: Plain cored casting for water jacket, to be chambered by machining

straightforward machining, is often possible.

In the plummer block pattern shown in Fig. 12, the cap is cast integral with the bodv. and intended to be cut off afterwards. A nick is provided all round to define the parting line, and the machining and fitting of the flat surfaces will call for allowance at this point. To be strictly correct, the cored hole in the casting should not be circular,

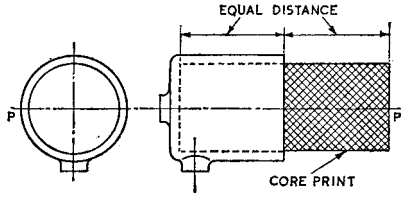


Fig. 14: ***Carburettor float chamber pattern, with print for blind core***

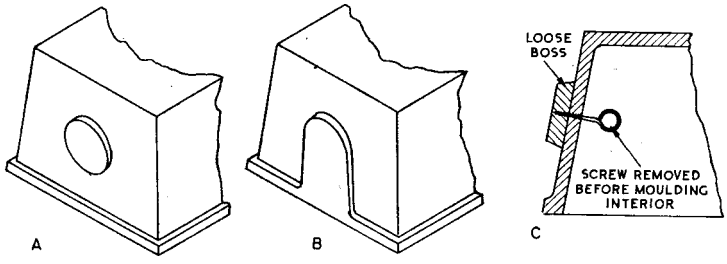


Fig. 15: ***Bedplate pattern with side boss***

but oblate. A plain round core will, however, be satisfactory, if the casting is not too large.

Even if the bore is to be chambered (as it is in some types of bushed bearings) it would hardly be worth while to make a special corebox; but if a deep well is required in the bottom half, to form an oil reservoir, such as in a ring-oiled bearing, the choice between machining the well from the solid, or making a corebox, would be definitely in favour of the latter-at least if more than one or two castings were required. The pattern may with advantage be split, with the parting on the vertical centre line.-

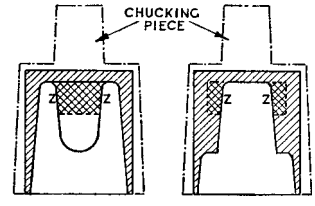
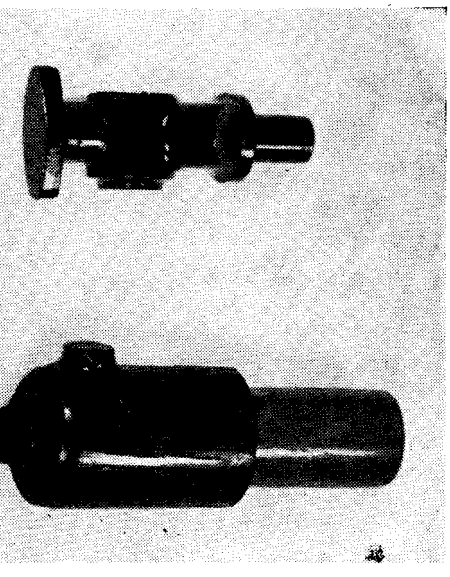


Fig. 16: I.c. engine piston pattern, which avoids the need for coring



Kiwi carburettor patterns: showing f?oat chamber with core print

Another example of a casting which involves the choice between a plain and a special core is the water jacket shown in Fig. 13. The chambered bore of this casting normally calls for a corebox, but as it only involves a straightforward boring operation, many constructors would be quite prepared to carry this out, if a plam core is provided as shown.

But the corebox would be worth while if any appreciable number of castings had to be made. The bosses on the top and bottom (for water connections in the case of a horizontal engine) would normally be drilled from solid? and screwed or flanged joints provided.

A stock core can be used to produce a blind hole in a casting, provided that it is not so deep that the overhung end of the core is too fragile or liable to sag. A typical example is the carburettor float chamber shown in Fig. 14. The general rule in such cases is that the length of the core print should be equal to the depth of the cavity; in other words, the core length should be twice this amount.

If a boss is provided on the side of the casting, as shown, the pattern may be split horizontally and moulded with the boss located vertically. Some moulders would prefer to set the axis of the casting vertically, so that the core could be set upright. This would call for parting the mould on the boss centre-rather undesirable, as it tends to make an untidy joint line all round the casting across the boss. An alternative arrangement would be to make the boss as a loose piece, which could be detached from the pattern before drawing, but this also has disadvantages.

Loose pieces are frequently used on large patterns, and may be required in certain cases, or as a simple alternative to a corebox. It may be necessary to provide a projecting boss or facing on a casting which in other respects is simple. For instance, the deep box bedplate (Fig. 15) such as may be used for a small gas engine, will normally draw quite easily if well tapered both inside and out.

But the presence of a boss (A) which may possibly be required for fitting a drain valve in the end face, would make draught impossible, unless the boss could be run right down to the lower rim and given some degree of taper, as in example ***B***.

'The practice of running out a boss

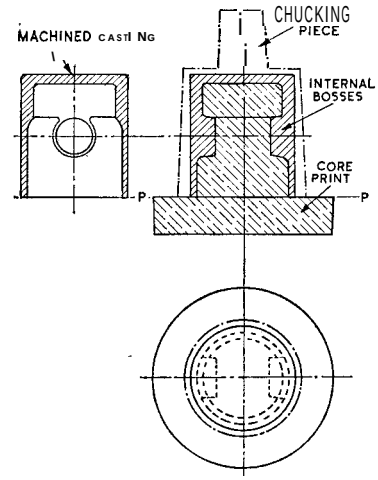


Fig. 17: Core print added to piston pattern to improve internal accuracy

or flange to the parting line is sometimes objected to on the grounds of appearance, or wastage of metal, but it is often the simplest way to get over a difficult problem, or complicated patternmaking. But a loose piece, attached to the pattern in such a way that it can be removed after the essential external moulding operation, may be considered a better solution.

In example C, the loose piece is a disc, held in place by a small screw eye from the inside of the pattern. When the outside of the pattern has been moulded, the screw eye can be removed, leaving the disc free, so that the main pattern can be drawn, and the disc also withdrawn sideways afterwards.

If the loose piece is any other shape than round, it will be necessary to attach it by two screws, or other suitable means to avoid its swivelling. Dowels or pegs cannot be used, as they would prevent withdrawal.

This is only a simple example of how loose pieces can be used: sometimes they are much more elaborate, and attached in various ways. In general it is best to avoid separate pieces in small patterns, because they all too easily become detached and mislaid. The conditions in a foundry, no matter what attempts are made to keep it tidy, make it difficult to keep track of small components.

Patterns are often required for pistons of small internal combustion engines, and though these are not really difficult, they present problems in design. The success of a small high-speed engine may be influenced bv the piston shape. Unlike the steam engine piston, which can be machined all over, the inside of an i.c. engine piston cannot easily be machined because of the presence of gudgeon pin bosses. Unless pains are taken to avoid superfluous metal and maintain uniform wall thickness, the piston may be out of balance and liable to distortion at high temperature.

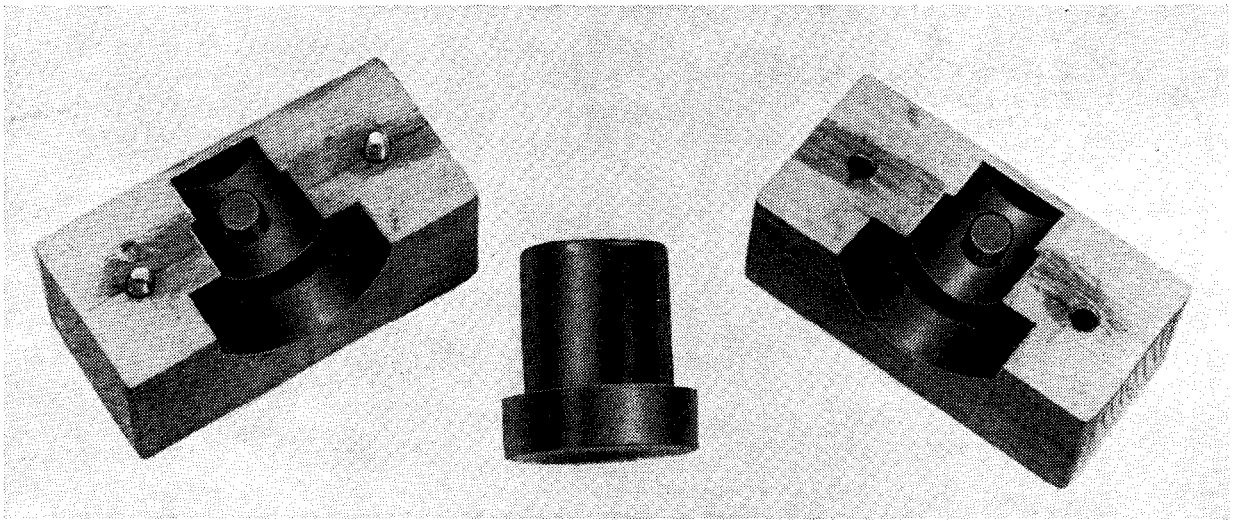
Attempts are often made to cast pistons without a core, by tapering the inside and carrying the bosses right up to the underside of the crown. This usually results in a heavier casting than is desirable, though it is possible to remove some excess weight by machining above the gudgeon pin bosses, at ZZ, in Fig. 16.

It is generally possible to obtain a better piston casting by adding a coreprint and providing a simple corebox. as shown in Fia. 17. The coreprint in this case is in the form of a flat disc, which I have found best to ensure good location and centring of the core, Some patternmakers prefer instead to make it as a long stalk, which should be tapered for easy insertion of the core in the mould.

Piston castings arc commonly provided with a chucking piecc as an aid to machining them 'all over at one setting. It is certainly helpful in this respect, but it can be a snare unless it is used with discretion. All too often the chucking piece is just gripped in the self-centring chuck, and nothing further is done to set it up truly so long as it will clean up to size.

But a tapered chucking piece cannot be relied upon for secure holding apart from what it does to the chuck jaws-and it should first be machined parallel, by reversing the casting in the chuck, and then set up in the four-jaw chuck, so that the inside (non-machinable) surface runs truly, before proceeding with the machining of the outside.

Chucking pieces are often made too slender to support the work adequately for overhung machining; I recommend that for this job, they should be made about half the diameter of the finished piston. The drawing of the machined casting in Fig. 17 does not show the ring groove or the cross bore for the gudgeon pin; but these obviously do not affect the design of the pattern.



Pattern and corebox for internal combustion engine piston

* ***To be continued on April*** 18

FOUNDRYWORK

Having made their patterns some readers may like lo attempt casting. B. Terry Aspin's book ***Foundrywork for the Amateur*** will supply the information they need. It covers all aspects of light foundrywork.

M, Aspin's book may be had from Percival Marshall Ltd, 19-20 Noel Street, London Wl, price 5s., or 5s. 5d. by post.