# SMALL WOODEN PATTERNS FOR MODEL ENGINEERING

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*Part V*

*From Page 413*

***Cores and Core-Boxes***

It would seem that originally a "core" was a solid shape of compacted sand which was placed in the mould to produce a cavity in the casting. The use of cores has been expanded greatly and extended to making moulds for castings which would be unmouldable using simple withdrawal patterns. Cores for producing cavities in castings are, generally made in core boxes from a mixture of silica sand (beach sand) and a binder, e.g. linseed oil. The core is baked to harden the binder and prevent the core from collapsing when handled and to make it strong enough to withstand the washing effect and the pressure of the molten metal. In the mould the core is prevented from moving by means of core prints. A simple example was shown in the previous article.

Standard round and sometimes square cores are produced in lengths by most foundries in core making machines. It is therefore convenient to design cylindrical holes in castings to take advantage of the nearest standard sized core. Cylindrical cores can of course be made by a number of other methods. Pieces of tube can be used, the sand being rammed in and forced out with a bar or wooden rod, which works well for short cores. A box can be made as shown in Fig. 5 in the previous article. The box halves are clamped together, the sand rammed up, then the box separated to release the core.

CORE

Note: construction in sections. Carve across the grain. Allow draft on end places.

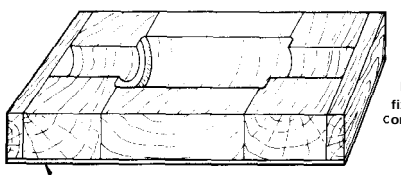





Fig. 10 CORE BOX

The core can be made in halves if it is symmetrical, and the core box would then have closed ends as in Fig. 10. The cavity is filled and the surplus sand screeded off. The halves are baked, then glued together with "core gum". Simple shapes which lend themselves to being made in halves or sections are

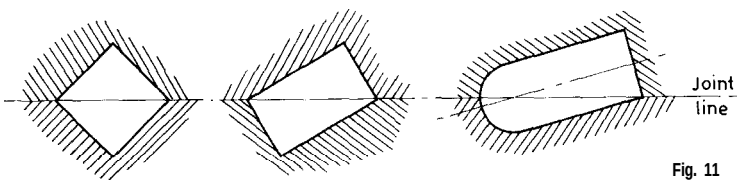


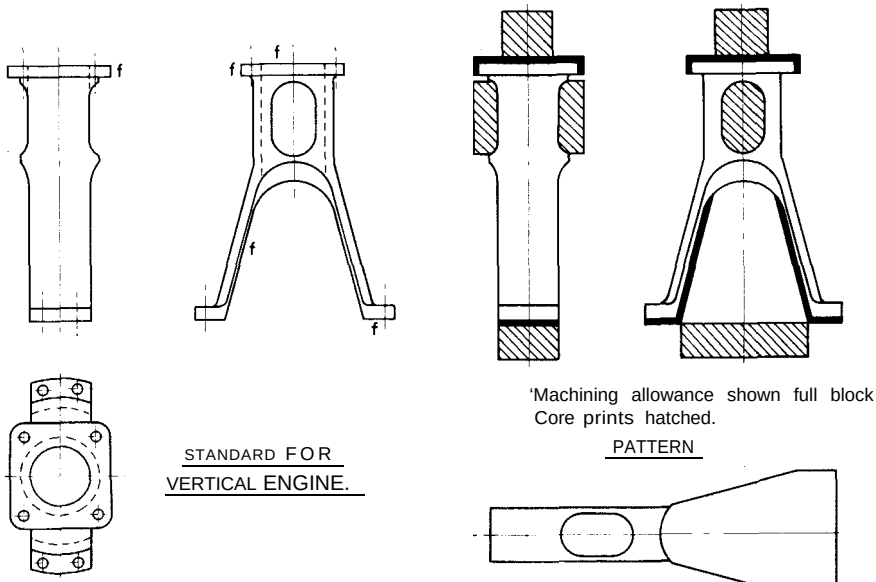

Fig. 11

| Metal of casting | Pattern colour | Core print colour | Machined surfaces | Sectioning for loose pieces | Stop off pieces |
|---|---|---|---|---|---|
| Cast iron | Black | Yellow | Red | Clear | Black and |
| Cast steel | Blue | Yellow | Red | with Red | Yellow |
| Non ferrous | Yellow | Black | Red | Stripe | Stripes |



COLOUR CODING FOR WOODEN PATTERNS

Fig. 12




STANDARD FOR VERTICAL ENGINE.

Fig.13

shown in Fig. 11. Where practical the natural draft of the section is used to advantage in making up the box, When cores have long slender sections, problems arise both during handling and when the metal is poured. Core material being lighter than the metal tends to float and long cores may need support both above and beneath. The core maker will incorporate reinforcing bars or wires in any core which he considers would distort during pouring, and the moulder will support long cores with "chaplets". Chaplets can be a source of trouble in the castings as they

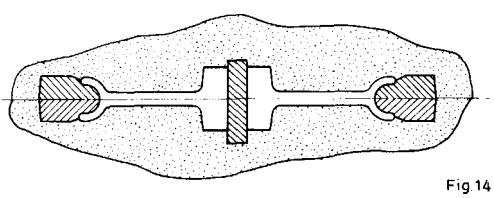


Fig.14

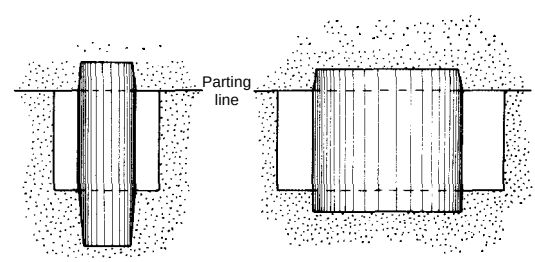
SECTION TWRU MOULD SHOWING CORES USED TO FORM THE GROOVE IN A ROPE PULLEY SHEAVE

remain in the metal, and if not clean and free of dust or oxides they can cause blow-holes. When considering whether to use a core, one needs to take these things into account. It is often preferable to cast the job solid than to risk imperfect castings. Your friendly foundry-man will advise where doubt exists.

In order to differentiate between core print and pattern proper, each can be painted in a contrasting colour. A convention exists for this, and also to indicate other things with respect to the pattern. How extensively this convention is used I do not know, but the one I am familiar with is tabulated below, for what it is worth. (Fig. 12) Powder pigments to make up the colour are available from patternmakers' suppliers. The powder is simply mixed into the shellac solution.

An example of pattern and core is shown in Fig. 13, for a standard of a vertical steam engine. The core would be made in halves and glued together. It can be seen how the core obviates the need to carve the slender sections of the legs of the standard. I have shown machining on the inside of the legs, as this simplifies the shape of the tapered section of the core to a minimum of draft. However, these surfaces could be finished "as cast" by incorporating the appropriate curvature on the core.

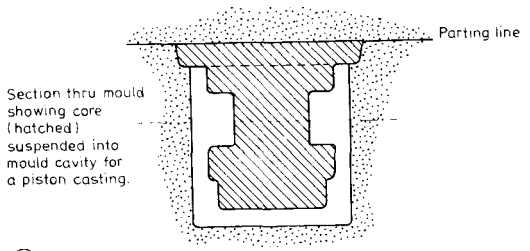
Fig. 14 is an example of moulding a grooved sheave for a rope pulley using cores to form the groove. The pattern would have a circumferential print to acommodate the core. The core is shown made in halves. Each half could be made up in segments to simplify the core box construction.



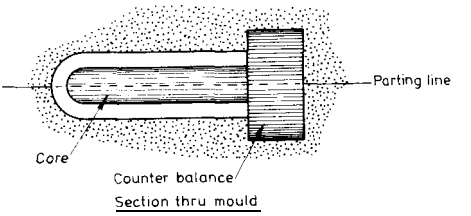

Typical core orranqement for vertical cores of small dlameter as compared with their length.

For short cores of large diameter, drag print and core base can be parallel Cope print and top of core should have generous taper

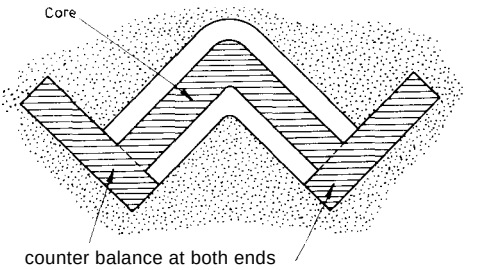
VERTICAL CORES Fig. 15




MUSHROOM CORE Fig 16

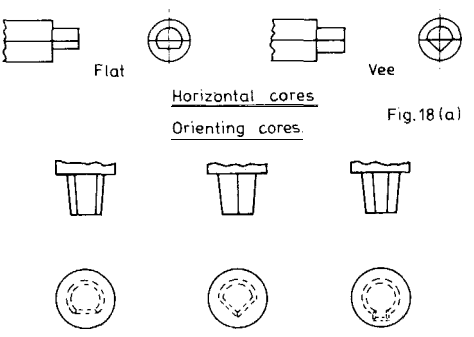



COUNTER BALANCED CORE Fig 17 (g)



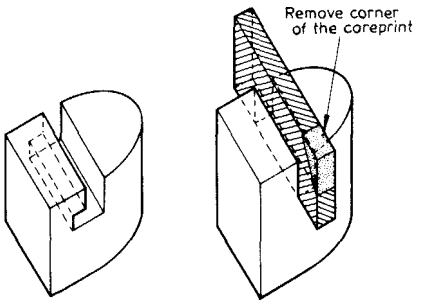

COUNTER BALANCED CORE Fig 17 (b)

As stated earlier, the core print is employed for locating and retaining the core in the mould cavity, both prior to and during the casting process. It follows that the extensions of the core which fit into the prints must be a good fit. For cores placed horizontally the prints will have the same dimensions as the core extensions, except for the ends when, if longitudinal location is not important, i.e. cylindrical cores, the core can be shortened. Cores set vertically, usually require some modification so that they are held close to truly vertical when the mould is being closed. The usual method of doing this is shown in Fig. 15. The core prints are made tapered, with the drag print longer than the cope print. The core can be made in a box or cut to length from a standard core piece, the tapers being formed by hand using an old file or similar means. Vertical cores with lengths smaller than their diameters would be exceptions from the above with only the cope end being tapered to correct any misalignment.



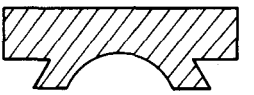

DRAG PRINTS FOR VERTICAL CORES

ORIENTING CORES Fig 18 (b)

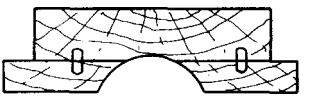



ASYMETRICAL CORES

Fig. 18 (c)

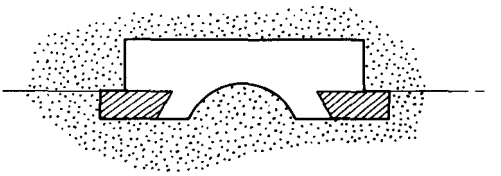


Section through piece to be cast



Pattern

Core box



Section through mould

CASTING DOVETAILS Fig. 19

Items such as pistons which have cores supported at one end only and can be moulded vertically could be cored using a "mushroom" core as shown in Fig. 16. When such a job is moulded horizontally the core will need counterbalancing as shown in Fig. 17(a). The counterbalancing for an asymmetrical core is shown in Fig. 17(b). When the core is irregular in shape and must be correctly oriented some provision needs to be made to ensure that the moulder gets the message. Core prints as shown in Fig. 18 can be employed for this purpose. From the foregoing I hope that I have conveyed to the reader the message that cores are a very versatile means of making up moulds for complex shaped castings. "Cores" can be used for shaping the outside surfaces of castings. Fig. 19 shows how a core can be employed to mould an undercut such as a dovetail.

Although I have limited these notes to wooden patterns, intricate core boxes are difficult and time consuming to carve or build up in wood. It can be expedient to make up core shapes in wood or some other material, from which a core box could be moulded in epoxy resin, polyester or silicone rubber. Literature on suitable material types and appropriate casting methods is available from the suppliers of these materials. Fig. 20 shows how a core box for a model locomotive cylinder can be built up from pieces laid up on a backing board. The pattern and prints are also shown. The minimum cross-section of the steam passages would probably be 1/4 in., thus the minimum size of the core is limited, because the box is symmetrical, except for the cylindrical riser of the exhaust outlet, a half box only is required. The riser hole could be plugged or the piece cut off for the other half core when that section is made.

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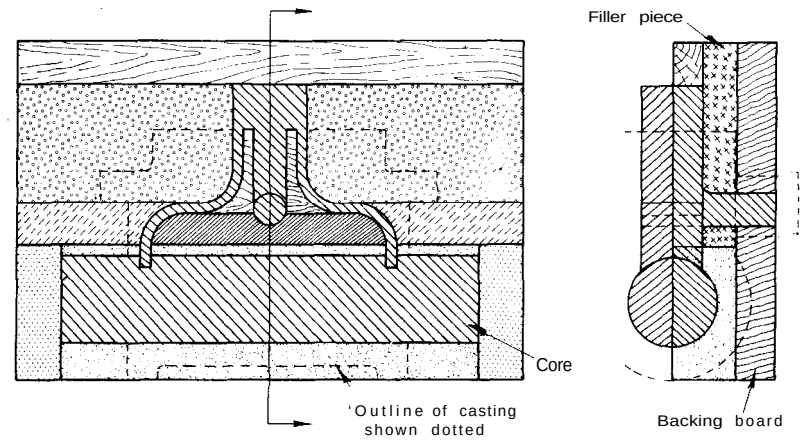
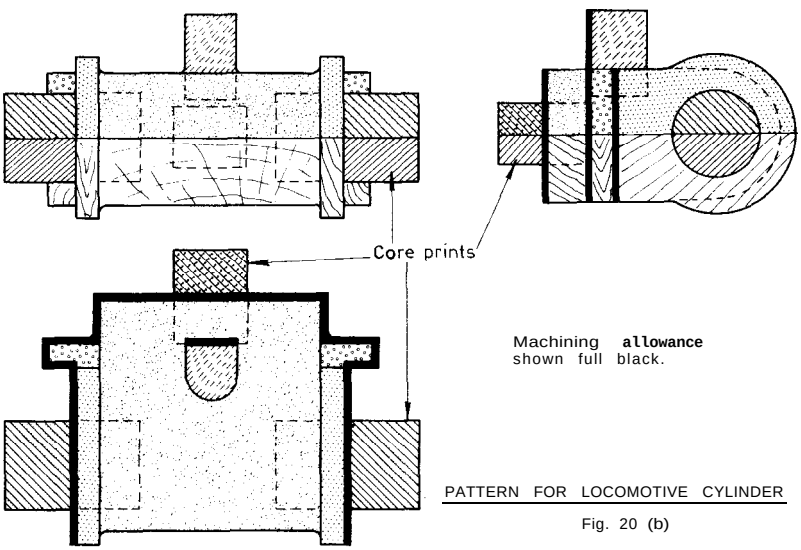





CORE BOX FOR LOCOMOTIVE CYLINDER Fig. 20 (a)






PATTERN FOR LOCOMOTIVE CYLINDER Fig. 20 (b)