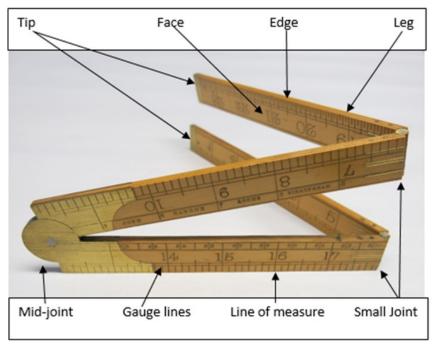


HOW IT WAS MADE

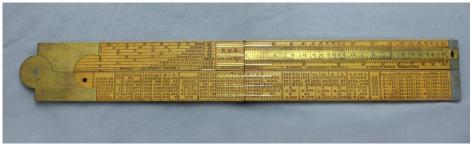
Boxwood Rules

A boxwood rule is used for measuring along a straight line and is marked with lines into divisions or spaces which represent a system of measurement. It is made from the wood of one of three different species of boxwood available from different areas of the world, English boxwood, Turkey boxwood and Maracaibo boxwood.



Parts of a boxwood rule

Some rules also had scales or tables marked on them for use by different trades and users to aid calculations and specific tasks.



Routledge Engineer's Rule – T.004802











The main centres of boxwood rule manufacture were London and the Birmingham/ Wolverhampton area; the trade was small in Sheffield with around half a dozen makers in the 1800s. James Chesterman, started in Sheffield in 1821, was a major manufacturer of measuring equipment but specialised in steel rules, wind-in linen tapes and the patented spring tape rather than boxwood rules. When Chesterman joined forces with John Rabone to become Rabone Chesterman the firm sold boxwood rules but they were made in Birmingham rather than Sheffield.

Stages in the manufacturing process

Preparing the slats or sticks

Boxwood logs were first cut into short lengths of ten or seven inches and quartered, then cut down further into slats using a fine saw to give a smooth cut and minimise waste. These slats were then dried to reduce the moisture content of the wood to around 9%.

The indented areas in the slats to take the joint leaves and tips would have been first punched on and then the wood removed using a chisel and later a milling (cutting) machine.

Slat with arch for join and slots for small joint - T.005307



Rules which were to have a slides added (as the engineer's rule above) had the groove cut using special slide planes and size stick planes and later using milling cutters.

Making the Tips, Pins, Mid-joints and Small Joints

These were usually made from iron or brass. Originally the pieces were cast – molten metal being poured into a prepared mould – but after 1769 a fly-press was used to stamp or cut out the correct shapes from sheet metal.

Mid-joints

The centre holes for the steel pin on the mid-joint pieces – heads, hollows and mid-plates –were drilled separately.

Piles of joint plates were then put together (up to 2 inches thick) on a vertical spindle and the arch (curved shape) of the joint cut by a blade moving backwards and forwards. They were cut together in this way so that the hole for the pin was always exactly in the centre.



Mid joint pieces – left to right, head, mid-plate, hollow -T.005307

Small joints

The small joints were composed of small plates, cut or stamped out with holes cut in the same way as the mid-joint pieces, and round washers. The washers were cut from circular brass or iron rod and hollowed out using a drill.

These joints could have a different number of plates, 4, 5 or 7, depending on the quality of the finished rule – the better the quality, the greater the number of plates. In the 1900s the plates for each side of the small joints were made from two different metals, e.g. brass and nickel-silver. This prevented the joint from changing shape/warping over time – galling.



Small joint pieces - T.005307

Tips

The tips were cut from brass strip and forged or shaped by first being made into a rough 'V', softened and re-shaped as necessary to give the final (three-sided) channel. A fly press would have been used to help this shaping process. One tip would be used for two slats.

Pins

The steel pins for the centre of the mid and small joints were cut and shaped like a barrel with both ends tapering slightly. Before steel was readily available iron or brass was used for the pins.

The fine pins needed to secure the joints to the legs/slats were usually made from brass wire and by machine by the late 1800s.

The pieces would all be finished – ground and polished. The mid-joints were then assembled, the centre pins of brass or steel being driven through the parts by hand. Later in the 1900s, the pins were driven in and then a small riveting machine was used. The small joints were also usually pre-assembled in the same way. The joints were then dipped in liquid wax and stored until needed.

Framing

This is the stage where the parts of the rule were put together. Pairs of slats would first be matched for colour and placed in a cramp (shaped holder with clips) with the midjoint. The cramp was put under a vertical drill operated by a lever under the bench and small holes were drilled through the joints and slats.

Pins were driven through these holes using a hammer to secure the joint into the slats/legs. This was a skilled task requiring a delicate touch so that the

metal piece or pin was not bent or the boxwood split. (Once the slats are matched and joined they are known as legs.)

The tips were then fitted by placing a pair of the end slats or legs of the rule in a holder. A pin was placed between the two legs and a single tip hammered over the ends of them both. The pin could then be removed, the tip cut between the legs and the excess filed off by hand to form the two tips.

The next process was to add the small joints - the legs were cut to the correct length and hollows were cut at the top and bottom to leave room for movement of the joint. The slots in the wood for the plates were cut using a saw and the plates driven into place with a hammer.



Legs joined by small joint with tip attached, pins and tip -T.005307

The mid-section and the tip or leg sections were then matched again for colour and placed in a cramp, holes drilled either side of the joint, through the plates and the wood, and pins hammered through in the same way as the mid-joint.

Filing

The surface of the assembled rule was then smoothed to make it flat on both faces ready for the lines to be marked on. This was achieved using a file by men known as 'filers-up', and sometimes using specialist rule maker's planes. The edges of the rules were also straightened at this stage in the same way or bevelled or sloping/shaped edges added. In the 1900s this was done using a cutting machine.

Finishing - Dividing or Marking

Before they were marked the assembled rules were rubbed with Shellac (a type of varnish). This was used so that the marking process would not raise the

grain of the wood and the blacking used to fill the markings did not stain the rest of the rule.

The rule was then divided – i.e. the line of measurement (or other line/scale) was marked onto it. It was placed in a jig known as a dividing board, next to a pattern or 'master' for the particular rule being made. The dividing lines were then drawn into the boxwood using a square and scribing knife. The worker lined up the square against the pattern by eye and drew in each division. A skilled worker could mark a 2ft, 4-fold rule in a couple of minutes with this equipment.



Dividing board with master, square and scribing knives – M49A

Next the gauge line – the horizontal line running just above one or both edges of a rule was scribed or drawn in using a type of woodworkers marking gauge. This line acted as a guide for the user to show the $^1/_8$ " and $^1/_4$ " marks. These lines were later put on by a gauge machine, with two cutting knives and a moving carriage.

Finally, figures (numbers), tables and any lettering were marked onto the rule using a mark punch and hammer along with the maker's and/or retailer's name. Each number would be marked in turn, i.e. all the 1's on all the rule, then all the 2's and so on.



Mark punches for figures - T.005146

Mark punch for a table – M49B



The marker used the same hammer (often made in the same works) with all the different punches, and from experience knew how much pressure to apply to ensure that every figure was exactly the same depth on the finished rule.

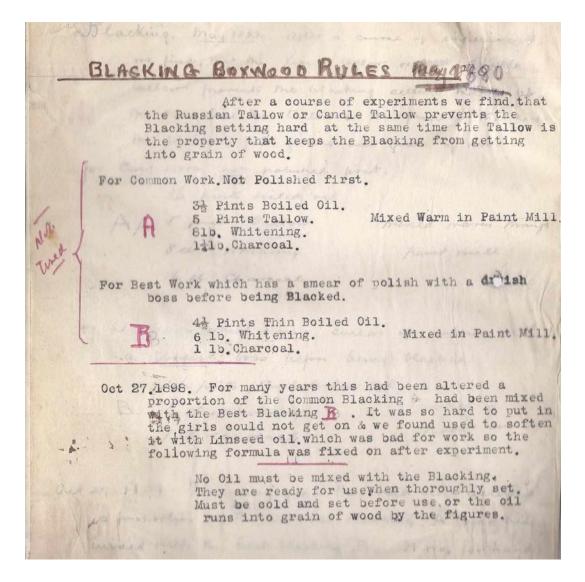
Later belt-driven punching machines were used for all but special rules. These had cradles which held the stamps /mark punches and punched the figures for an eighteen -inch length in one operation.

Finishing

The finishing room was often called the Rushing Shop. Here the rules were first wiped with Shellac and all the lines and numerals were then filled with blacking which was rubbed on with a rag, piece of cloth. The blacking was usually a mixture of charcoal dust, whitening (powdered chalk/calcium carbonate), tallow and oil (linseed or other).

The excess blacking was cleaned off originally with rushes (hence the name of the Shop) and later by rubbing the rule in a box of sawdust. No particular drying time was needed for the blacking. The rules were finally hand polished.

Different manufacturers at different time periods varied the finishing process, varnishing, polishing, and rushing a different number of times before and after blacking and changed the recipe for the blacking and varnish.



Rabone Blacking Recipe, 1880 - ARC 100 - Work Receipts Book

The whole of this part of the manufacturing process was done by hand, usually by women and was to protect the wood and prevent the metal from tarnishing.

There is a film demonstrating this process available to view on the screen in the Hawley Gallery. If you would like more information about boxwood rules and related items in the Hawley Collection, please contact us:

via our website: www.hawleytoolcollection.com by email: enquiries@hawleytoolcollection.com

by telephone: 0114 2010770