

to, and also also demonstrated in the library during the evening.

The lecture was concluded with the following peroration :—

“An old and trite subject is thus seen to have, in the light of theory, an unexpected charm and brilliancy. So it is with a great number of old and familiar facts at the present time. The present is an era of astounding activity in physical science. Progress is a thing of months and weeks, almost of days. The long line of isolated ripples of past discovery seem blending into a mighty wave, on the crest of which one begins to discern some oncoming magnificent generalization. The suspense is becoming feverish ; at times almost painful. One feels like a boy who has been long strumming on the silent keyboard of a deserted organ, into the chest of which an unseen power begins to blow a vivifying breath. Astonished, he now finds that the touch of a finger elicits a responsive note, and he hesitates, half delighted, half affrighted, lest he be deafened by the chords which it would seem he can now summon forth almost at will.”

THE JOINER AND HIS TOOLS.

BY OWEN B. MAGINNIS.

The paring tools of the joiner consist of the draw knife and chisels, gouges, spokeshave, scraper, hatchet.

The draw knife as represented (fig. 25) is more a cooper's than a joiner's tool, yet it is most useful to the joiner in gauging, or rather bringing boards to a width by preparing them for the plane by taking off the superfluous stuff.

The chisel runs in sizes from $1\frac{1}{8}$ in. wide up to 2 ins. wide, and is undoubtedly indispensable, being necessary for paring and cutting. There are firmer (fig. 26) chisels, socket (fig. 27) and bevel edge chisels and mortise chisels, all useful in their own way, the socket for using under the mallet or by hand pressure, the firmer for paring and the bevel edge (fig. 28) for getting into corners and fine fitting. The last is a beautiful chisel, and but little used. The mallet mentioned above is made as shown (fig. 29) of ash, beech, or hickory. Lignum vitæ mallet heads are common, but experience will show that a very hard mallet means many broken and split chisel handles.

Mortise chisels are used for making apertures or mortises in the wood with the chisel by striking the latter on its handle and making an incision in the wood by the blow.

Gouges are likewise made in sizes and of different radii. There are outside and inside cutting gouges (fig. 30), the latter being ground on the concaved side for paring and straightening concave work or sweeps, and the former for hollowing, or, technically speaking, gouging. To these are added bent gouges for shaping interior mouldings, etc. The spokeshave finishes what the gouge has gone over, making it smooth and obliterating the gouge-marks and making ready for scraper and sand-paper. The sketch in fig. 31 shows this tool ; the edge of the cutter can be set for different purposes. The ordinary scraper is a thin plate of well-tempered steel about $3 \times 4 \times \frac{1}{16}$, with the edges burred to insure its cutting ; a piece of a broken saw-blade answers the purpose admirably if the temper be good, but it is difficult to cut the blade to the required size. Scrapers are now made similar to a plane, or like fig. 37, but the above is the original, and when well sharpened will take off a shaving. It is sharpened by jointing the edge perfectly square and straight with a flat file and then turning arrised corners with a smooth instrument as a gouge.

Saws are thin plates of steel diminishing in width to the point so as to throw the weight to the handle, and cut on one edge into triangular or wedge-shaped teeth, which are set or slightly bent every other to each side of the blade. They are used by pushing it forward and drawing it back again, the power being applied vertically in pushing. The back of the teeth make different angles with the saw line, and are filed to suit their several purposes.

The joiner requires six saws, namely :

The ripper (fig. 32).

The cut-off or cross-cut (fig. 33).

The panel (fig. 34).

The tenon (fig. 35).

The compass (fig. 36).

The keyhole (fig. 40).

All joiner's saws, excepting the tenon and dovetail, should be of parallel thickness of teeth and diminish to the back to enable the saw to run easily in close-grained stuff. When buying a saw the joiner takes it by the handle and shakes the blade to try if it is buckled. He always selects a warranted make of the best known makers, so that he can change it if defective.

The ripper (fig. 32) is 28 in. long and 8 in. wide, diminishing to $2\frac{1}{2}$ in. on the point, made stiff with a double handle fastened by screws to the blade, and has its teeth with their front or right angles to the saw line and filed square to the side of the blade.

It is used for ripping or cutting the wood with the grain, and cuts like a chisel. Its teeth are about 3 to 5 to the inch.

Hand saw or cross-cut is used for cutting the wood across the grain only, and varies in length from 24 to 26 inches. It is usually with the teeth at less rake than the ripper or rip-saw, and with a slight flem or bevel to rapidly sever the fibres. The teeth are now cut from 7 to 10 to the inch, and the saw has a slight crown or convex curve on the teeth line. This saw is well ground to the back to avoid buckling and sticking in the wood when working.

Panel saw (fig. 34) is employed in fine panel work or for cutting panels and trimming in houses, as the fine teeth and thin blade make a close, clean cut. It is usually from 10 to 20 inches long, and the only saw with which a close joint can be made. The teeth are spaced from 10 to 12 to the inch.

Tenon saw (fig. 35). The joiner uses the tenon or back saw to cut the shoulders of tenons or to a knife mark in making a perfectly straight shoulder or butt joint across grain. Its length runs from 14 to 19 inches and the teeth from 8 to 15 to the inch. As it is only used for keying or making shallow cuts, its blade is a very thin, rectangular plate of steel stiffened with a thick piece of iron or brass, bent over its upper edge as shown, thereby preventing the blade from buckling.

The dovetail saw is employed in dovetailing ; the length of its plate is about 9 inches and the handle is single.

The compass saw (fig. 46), as its name implies, cuts round sweeps or circles struck with the compasses. Its handle is single, teeth about 7 to the inch and blade about 8 inches long, diminishing from 1 inch broad at the handle to $\frac{1}{4}$ inch at the point. It ought to be concaved or diminished to the back.

Keyhole saw or pad saw is inserted in a pad or handle slotted through from end to end to let the saw run into the handle. The lower end is fitted with two set screws to set the blade fast in the handle. On account of its being