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SHARP SAWS.

THE saw is of very early origin in the history of man, as many of the ancient structures could not have been built without it. The British Museum contains saws known by their stamp to have been made two thousand years before the Christian era. They have frequent mention in Scripture, noticeably in Samuel, 1083 B. C., and in Isaiah, 742 B. C. In the Stone Age saws were made by securing pieces of flint for teeth in wooden handles, with bitumen, and similar articles have been used by other people. The Japanese make their saws like cleavers, with their teeth pointing toward the handle. The circular saw and other improvements probably came in late in the eighteenth century.

All work in wood is done either by sawing or cutting, and sawing is only a different way of cutting. The teeth of a saw work like a series of chisels, and a chisel-shaped tooth is the best for a rip saw in theory. In practice, however, the slender point of such a tooth will break away before knots of hard wood. A very different tooth is needed for cutting across the grain, as the work here is more difficult, requiring the teeth to be filed well back for cutting from the sides of the point, in order to sever across the grain of the wood. The length and size of saw teeth must vary for the various kinds of wood, requiring to be shorter and smaller in harder wood. Seven to ten teeth to the inch is about the right size for general purposes in hand saws.

The same rule applies to the angles of the teeth, the angle being less thrown forward for harder woods, either in crosscut or rip saws. The set of the teeth should be no wider than is required to make the saw run smoothly, as more than this makes needless work. The set must be wider in green or sappy or soft and springy woods than in the opposite. Rubbing the saw with an oily rag helps by lessening the friction, also by preventing rust, and further, a saw should be chosen which tapers thinner to the back. In buying a saw get from the make of some reputable firm, one with a thin blade, dark color, hung right and tight in handle, one that rings clearly when tapped, and bends evenly when sprung to either side, and with handle thoroughly dry and unsprung, as that springs the blade out of true.

Get all your set from the tooth and none from the blade, as this strains and distorts the blade. A good saw set is better than hammer and punch in the hands of a beginner. Set the saw before filing, and in cold weather warm the saw to prevent the teeth breaking when set. The back saws have very small teeth and generally need no setting, as the filing gives sufficient. Backed saws frequently become warped and buckled if used roughly. This is caused by a blow on the centre of the back, causing the blade to slip into the back at that point. Remedy by tapping lightly on the ends of the back until the ends are drawn in even with the centre.

Lay the stuff on benches; if thick rule on both sides and turn frequently to prevent the saw wandering. Keep your eye above your hand, or you may be misled. Keeping open the crack with a wedge assists both in the cutting and steering process. The teeth should have been filed evenly, as if longer on one side they mislead the saw in that direction.

The rip saw is easiest to file, as being level on the points of the teeth it is simply filed straight across the blade, with the file held level from point to heel, and at the proper sidewise tip to give the upper angle or pitch to the teeth. Take hold of the tip of the file with the left hand so as to secure steady work, and file only on the push stroke, as this will give you better work and greatly save the file. The crosscut saw is harder to file than the rip, owing to the teeth requiring a point. With file in hand, as above, and saw in trim, proceed as above, only with the file at the proper sidewise angle to the blade to give the point required by the tooth. File one side first, then reverse the saw in the clamp and proceed as before, giving the same pitch to the teeth, and the work is done. The great requisite of a filer of saws is carefulness in all the particulars.

As soon as the tooth is brought to its proper level stop at once, or you will do much harm to your work. No definite rule can be given for size of teeth, as wood that is either soft, green, or in a large stick or log, requires a larger tooth for clearance than is needed in the reverse conditions. In hand saws the farmer will get the best use from the smaller teeth, as they will saw in both soft and hard woods. Compass saws and all of that class do better work filed square on back of teeth as in the rip, and a slant in front as in the crosscut saws, as they are required to part wood in all directions. The V tooth in large crosscut saws should be slightly longer than wide. The M tooth of itself cuts powerfully into the wood, but is regulated in its depth by the alternate cleaner, which is filed enough shorter to give the tooth a proper hold and no more.

In selecting a file, choose one with an even, whitish color, as this denotes evenness of temper. Also choose one with the name of the maker upon it if you want the best, as the makers only put their names upon their first-class files. If there is a difference in weight between those of the same size, select the heavier, as they are generally better. The boards for filing should be about four inches wide, hollowed out to fit over the handle, top edge rounded to give room for filing, and long enough to permit screwing them together just beyond the point of the saw. Saw sets for general use are best provided with a set screw to regulate width of set. The cheapest form, next to the hammer and punch, which are entirely to be recommended, is simply a little square of steel with handle of the same, and with different sizes of notches along the sides. Where care is taken to use this on each tooth alike, no better set is required.

LINING UP AN ENGINE.

By ROBERT GRIMSHAW IN MILLING.

THERE are few things which show the care and ability of an engineer or of a machinist more than this matter of lining up. Some call to mind the old proverb that every hair of a carpenter's head is an eighth of an inch in diameter, owing to the fact that the average carpenter will work to an eighth of an inch where almost every other mechanic would work to a hair's breadth. Others seem to appreciate the fact that a very slight variation at the cylinder end of the engine may amount to a great deal at the crank pin.

The first thing to do is to see that the foundation is level and firm, second that the engine bed is as nearly level as is practical to get at with the aid of levels and sighting strips. The bed must be leveled, both lengthwise and crosswise. If it is so in these two directions it will be in every diagonal direction also. The longer the level used, the more accurate the result that can be got. For cross leveling, where there is not a chance to use a long level, the sighting strips will often come in very handy. They are simply long and absolutely straight and parallel strips of wood (preferably cherry) of equal width and used in pairs. Being laid crosswise on the engine on the guides, at opposite ends, as far apart as possible, and one of them being shown to be perfectly horizontal by the application of the level, the other should sight fair with it at both ends. A very slight twist will bring one end or the other, or both, of one of the strips, out of line with the other.

The circularity and parallelism of the cylinder bore having been proved by a piece of stout wire, pointed at both ends, and just as long as the diameter of the bore, the cylinder must be shown to be level, if it is a horizontal engine (and we are talking now only of horizontal engines), by the application of the level. The truth of the flanges may be tested by a steel square and the level; this is desirable in those cases where the guides are on a distance-piece bolted to the cylinder. The flange faces may be plumb, yet skew horizontally with the cylinder bore; this cannot be shown by the plumb, square or level; and either of these faults is a most serious one, which does not happen once in a hundred times, but which, when it is found to be the case, gives so much trouble at first and afterwards as to call for being remedied by the builders that is, in those cases where the guides are bolted to the flanges, or the cylinder bolted as in the Porter (so-called tangye) pattern. The guides may be tested for level by the level. If they are level and the cylinder-bore is circular, parallel and level, the guides, if level lengthwise and crosswise, will be parallel with the cylinder axis and at right angles with the cylinder-flanges. If the guides are higher at one end than at the other, it will be shown by the level. If they are askew, that may be shown by the sighting strips.

To be sure that the guides are in line with the cylinder-bore there are two ways, one to be sure that they are square with the face of the flange which bolts to the cylinder and which constitutes one cylinder head. If the cylinder flanges are square with the bore and the guides are square with the face of the head, then the guides will be parallel with the cylinder bore.

Where this distance-piece construction is not followed, the guides will have to be lined with the cylinder bore by a cord passing through the centre of the bore, being there held at the rear or "out" end by a strip wedged into the bore, and passing at the other end of the bore through a spider made of metal for the purpose, or of wood for the special occasion, this line being prolonged as far as possible beyond the crank.

If the shaft when laid in its bearings is higher at one end than at the other, that may usually be shown by the level, or by a plumb held against the crank web or disk this last, however, assuming that the crank is truly at right angles with the shaft centre. If the shaft is no higher at one end than at the other, but is out of square with the cylinder-bore in a horizontal plane, that may be shown (assuming that the crank is at right angles with the shaft) by applying a sighting-strip horizontally to the face of the crank web or disk and sighting a point at a known distance from the cylinder-bore; this being determined by T-squares from the centre-cord. The crank-pin will show, by being further from the centre line when on one of the dead centres than on the other, whether or not the crank is at right angles crosswise to the cylinder-bore in the horizontal plane. The shaft-bearings can be tested independently of the shaft, with the latter removed, by drawing a cord through the centres. The piston head must be made exactly central with the cylinder-bore, and the cross-head made at the proper height with the latter, and also square with it and with the guides.

To recapitulate. The following are the points to which suspicion must be directed and where correction must be removed for them if they are not found correct.

Cylinder-bore.—Level.

Front Cylinder Flanges.—Plumb and at right angles with the cylinder-bore.

Guides.—Level lengthwise and crosswise; parallel with the cylinder-bore; at right angles to the cylinder-bore; at right angles to the cylinder flange.

Crank.—Level; at right angles with the cylinder-bore; at the same height with the cylinder bore.

Piston.—Central with the cylinder-bore.

Crosshead.—Central with the cylinder bore, at right angles throughout, and at the proper height.