

carver, is not intended to discourage the latter, but simply to remind him what a vast and endless field of variety is spread before him, and that, to achieve success at all, correct application and method must be the starting point.

The tools used by wood carvers consist of square firmer chisels, corner firmers, flat and quick gouges, parting tools, veiners, grounders, bent-backs, chaser, picker and point; nearly all kinds are both straight or crooked, and the number varies from sixteen to twenty dozen. My own stock consists of quite the latter number, varying in size from the 64th part of an inch to $1\frac{1}{4}$ inches, and not one but is occasionally used, besides a variety of stamps for ground work, borders, etc. For sharpening the tools an oil stone and a quantity of Turkey arcansa. Charnley Forest blue stone, and thin slips of slate, to fit the various shapes and sweeps, besides the use of flour of emery and oil for all the very finest tools, and a prepared strop for producing a fine edge. It is rare that an apprentice can properly sharpen his tools at the expiration of his term, and some men never have the patience to put their tools in proper order. Perfectly shaped tools (with the exception of chisels and grounders) should have a slight curve from right to left, and should be rubbed out from the inside, as well as ground from the outside; the latter is done by getting different thicknesses of quick cutting York sandstone, and sharpening to the curve of the tool before rubbing out, to make thin on the edge and wedge shaped. The crooked tools must be done on small wheels, on a spindle attached to a lathe, with emery and oil. For soft wood, tools require to be very thin (for clean cutting), and for hard wood, *vice versa*. The various forms of delicate tools to be found in a carver's perfect outfit are invaluable, and cannot often get into the hands of amateurs; and if they did they would soon become useless, on account of the skill required to keep them in proper order.

As soon as any piece of work is put into the carver's hands, his first question is how to hold and execute it without injury or soiling. The methods are very numerous, but the use of the carver's screw and holdfast are the principal. For carving fret work one method will be sufficient. A bench or plank three inches thick, of any size, faced up true, that the work may lie firm and even upon the surface, and a few small screws, after the manner of carver's screws, placed round the edges, or in the strongest part of the centre of the work, is the best method. The wood selected for fret work and carving ought to be free from shakes and knots, not too hard and steely, and yet not too soft and dead—a medium between the two extremes. The latter exists more or less in all kinds of wood. If the wood is too hard it turns the edge of the tool, and if too soft or woolly it puzzles the amateur, because even the sharpest of his tools refuse to cut it kindly. It generally happens that fine grained soft wood is best, and hard wood should be light in proportion to its bulk. It should be well seasoned to prevent curling. As I have said before, the best quality is not the most abundant. Experience will best teach what is best to use. The workman having selected the wood, and fret worked some simple pattern (one that has been prepared and outlined for carving), and secured it to his bench by the method above named, will find nothing more puzzling than the mastery of the grain. Tearing, splitting, and breaking off, are the first fruits of his labor. One general rule must be observed, viz.: commence working at all the parts to be cut deepest, and to use our term, roughed or bolstered out. Then take most tender parts, working from the weakest to the strongest parts, such as the points of leaves towards the centre. All that can be should be done without turning the work about, but rather than risk injury turn it sufficiently. Try to use both hands as soon as possible, and, whether the tool be in right or left hand, use one as a guide and defence to govern the tool from blundering forward. The wrist or arm should be pressed upon the bench to assist in government of the tool. Let the tool cut away all the wood it can fairly, but better under than over the mark. Be careful not to force the work. The shapes of tools should fit the work to be executed, and the tools should be changed as the form of the work changes. In cutting diagonally across the grain guard against tearing, using a flat tool at right angles from the direction you are working, and pare it down carefully to the shape required; draw the edge of the tool lightly over difficult parts, like a scraper, but avoid it, if possible, as it blunts the tool, and it is unwise to blunt it unless you are prepared and competent to sharpen it. Go on with regular method; avoid rambling from one part of the work to another. Guard against the childish desire to see the work finished before it is fairly begun; this weakness frequently spoils the whole undertaking. In finishing work, work away from the parts you are executing; by this means you avoid injury, breaking or soiling.

A hard, short hog's hair brush is used with advantage and good effect when the carving is finished; a stiff piece of brown paper may be laid upon the completed part, to keep it clean while the rest is being executed. Tools properly prepared for such light work as fret work, ought, with the application of a properly prepared strop, to be sharp enough to work for months.

The form of leaves is executed in an endless variety of ways regardless of thickness. Although the generality of nature's forms are flat, we take unbounded liberty with them; we treat them either naturally or conventionally, terms we understand in all branches of the trade. The correct outline of most foliage should be, and is most generally followed. Leaves are formed quite flat, convex, concave, wavy, high in the middle, low or hollow on the edges, half turned, right or left, turned over or lapped over; the veins of leaves are raised, or sunk or lined out; the edges are round, saw toothed, or ragged, and often for correct and good appearance have a small square taken off their entire edges. Flowers of three, four, five leaves or more are treated similarly to leaves in many respects. Fruit, such as berries, pods, petals, or cups, are either rough or smooth. Stems are either round, square, or octagon, straight, or in short lengths, from knot to knot, or twisting. The tooling of the stems consists of straight lines, alternate straight lines, twisted lines, in hazled zig-zag fashion, using the tool from right to left with a rocking motion. Sometimes the whole of these methods are used at once with stamps to give the appearance of the roughest bark. The form of corn is generally bold and prominent, following its ripe appearance. The grass of wheat and barley has an endless variety of twists, with fine lines running through on either side. Natural specimens are of course always the best guide, but when not attainable the beautiful and careful construction of artificial flowers can always be obtained.

HINTS TO THE YOUNG STEAM FITTER.

BY WM. J. BALDWIN.

HEATING SURFACES.

All radiators, box coils, flat coils, plate or pipe surfaces, arranged to warm the air of buildings, are heating surfaces.

The vertical tube radiator is now the accepted type of a first-class heater, and most all manufacturers have their own peculiar style with varying results as to efficiency, and the steam fitter or purchaser should use great caution in the selection of radiators.

The common return-bend radiator, Fig. 1, is the most widely manufactured, it is not patented, and is second to no other vertical tube heater.

The construction is simple, a base of cast iron, A, being simply a box without diaphragms, with the upper side full of holes, about $2\frac{1}{4}$ inches from centre to centre, tapped right-handed; a pipe, B, for every hole, 2 feet 6 inches or 3 feet long, threaded right and left handed, and half as many return bends, C, as there are pipes tapped left-handed.

The manner of putting these heaters together is to catch the right-handed thread of two pipes one turn in the base, then apply the bend to the upper and left threads of the same two pipes, and screw them up simultaneously with a pair of tongs on each pipe, and a second person holding the bend with a wrench made for the purpose.

Steamfitters who buy bases and make only a few radiators to keep the boys at work when in the shop, should count each set of threads in, but they who make for the trade gauge their threads and pipes so as to always enter the base first. If the pair of pipes in any one bend are not plumb, screw the pipe at the side from which they lean a little tighter; this will shorten that side and draw the bend over.

I will here explain the action of steam entering a radiator, as nearly all the patents on the so-called positive circulating radiators are to facilitate the expulsion of the air and the admission of steam.

The general impression among steamfitters is that when steam enters a radiator the air is backed up and confined in the top of the pipe, and so it will be when the pipe is single and closed at the top, without any of the usual means to get it down; *this is so*, although steam is not quite one-half the weight of air, and it may seem an anomaly to the scientific engineer.

When two pipes are connected at the top with a bend, or when there is an inside circulating pipe or diaphragm of sheet iron slipped into it, the air immediately gives way and falls in the pipes nearest the inlet first; but should there be no air valve on