PRACTICAL MECHANISM.

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PATTERN MAKING.

Of the different kinds of wood serviceable to the pattern maker, pine is, for many reasons, usually employed. It should be of the best quality, straight-grained, and free from knots; it is then easy to work in any direction, possessing at the same time sufficient strength for all but the most delicate kinds of work, and having besides the quality of cheapness to recommend it. Care taken in its selection at the lumberyard will be amply repaid in the workshop. When it is straight-grained, the marks left by the saw will show an even roughness throughout the whole length of the plank; and the rougher the appearance, the softer the plank. That which is sawn comparatively smooth will be found hard and troublesome to work. If the plank has an uneven appearance, that is to say, if it is rough in some parts and smooth in others, the grain is crooked. Such timber is known to the trade as catfaced. In planing it, the grain tears up, and a nice smooth surface cannot be obtained. Before purchasing timber, it is well to note what convenience the yard possesses for storing. Lumber on the pile, though it be out in all weathers, does not deteriorate, but becomes seasoned; nevertheless its value is much increased if it has an extemporised roof to protect it from the sun and rain: but as it is not convenient to visit the pile for every customer, quantities are usually taken down to await sale, and for such a shelter must be provided, otherwise it will be impossible to insure that the lumber is dry, sound, and fit for pattern making, it being obvious that the foregoing remarks on the storage of lumber apply to all woods.

The superiority of pine for pattern making is not, however, maintained when we come to fine delicate patterns or patterns requiring great durability. When patterns for fine work, from which a great many castings are to be made, are required, a fine pattern wherefrom to cast an iron pattern is improvised, because, if pine were employed, it would not only become rapidly worn out, but would soon warp and become useless. It is true that a pine pattern will straighten more easily than one made of a hard word; but its sphere of usefulness in fine patterns is, for the above reasons, somewhat limited. Iron patterns are very desirable on account of their durability, and because they leave the sand easily and cleanly, and because they not only do not warp but are also less liable than wooden ones to give way to the sand, while the latter is being rammed around them by the molder, a defect that is often experienced with light patterns, especially if they are made of pine. Iron patterns, however, are expensive things to make, and therefore it is that mahogany is extensively employed for fine or durable pattern work. Other words are sometimes employed, because they stand the rough usage of the molding shop better and retain the sharp corners, which, if pine be used, in time become rounded, impairing the appearance of the casting. Mahogany is not liable to warp, nor subject to decay; and it is exceedingly durable, and is for these reasons the most desirable of all woods employed in pattern making, providing that first cost is not a primary consideration. There are various kinds of this beautiful wood, that known as South American mahogany being chiefly used for patterns.

Next to mahogany we may rank cherry, which is a very durable wood, but more liable to twist or warp than is mahogany, and it is a little more harsh to the tool edge. If, however, it is stored in the workshop for a length of time before being used, reliable patterns may be made from it. In addition to these woods, walnut, beech, and teak are sometimes employed in pattern making.

The one property in all timber to be specially guarded against is its tendency to warp, bend, expand, and contract, according to the amount of humidity in the atmosphere. Under ordinary conditions, we shall be right in supposing a moisture to be constantly given off from all the exposed surfaces of timber; therefore planks stored in the shop should be placed in a rack so contrived that they do not touch one another, so that the air may circulate between the planks, and dry all surfaces as nearly alike as possible. If a plank newly planed be laying on the bench on its flat side, the moisture will be given off freely from the upper surface, but will, on the under surface, be confined between the bench and the plank: the result being that a plank, planed straight and left lying as described, will be found, even in an hour, to be curved, from the contraction of the upper surface due to its extra exposure; and therefore it is that lumber newly planed should be stored on end or placed on edge. Lumber expands and contracts with considerable force across the grain; hence if a piece, even of a dry plank, be rigidly held and confined at the edges, it will shrink and rend in twain, often with a loud report. There is no appreciable alteration lengthwise in timber from the above causes; and if two pieces be glued together so that the grain of one crosses that of the other, they can never safely be relied upon to hold. Hence they had better be screwed so that there will be a little liberty for the operation or play of the above forces, while the screws retain their hold. The shrinkage, expansion, and warping of timber may perhaps be better understood by considering as follows: The pores of wood run lengthwise, or with its grain, and hence the moisture contained in these passes off more readily endwise or from any surface on which the pores terminate. Then again the wood shrinks precisely in proportion in which the moisture leaves it; and if we have full knowledge of the direction of the grain, and of the position in which a piece of timber stands or lays, we can (all other things being equal, that is to say, supposing there to be no artificial heat or other disturbing cause operating on one more than on another side of it) predicate in what direction it will warp. Thus, let A,

Fig.1.

Fig. 1, be a piece of timber having the direction of its grain as denoted by the lines; then its surface, B B, which has the grain and pores terminating upon it, would allow free exit of the moisture, and that face would dry first (especially if it lay uppermost) and would contract the most, so that after a time the shape of the piece would be curved, as shown in Fig. 2. Now if it had been placed to lay with the face, C,

Fig.2.

uppermost, the warping would have been much less, because the extra porosity of the face, B B, would have been counteracted by the lack of circulation of air. If, on the other hand, it was placed endwise, the warping, though it would have taken place, would have been appreciably less. It must not be supposed that thoroughly seasoning the timber will remove the tendency to warp, for timber, however long and carefully it has been dried or seasoned, undergoes considerable transformation of shape so soon as much of its outer surface is removed, making it appear that the seasoning or drying process takes place mainly at and near the outer surfaces, and is renewed every time an entirely new surface is presented to the action of the atmosphere. Thus, if we take a thoroughly seasoned piece of wood 3 inches square and 1 foot long, and cut it into strips 1 inch square and 1 foot long, the pieces will warp in a day or so; and if, after a few days, we take those inch strips and cut them into strips ¼ inch square and 1 foot long, these latter will again warp; and no matter what pains might be taken with these last strips to season them and let them assume their new shape, were we to cut them into thin veneers the warping process would again set in. It is well, therefore, in particular work, to cut out roughly the various parts of the pattern, so that, while some parts are being operated upon, the others may be assuming their new shape, and thus become not so liable to warp after being worked up in the pattern.

TOOLS, ETC

One of our first requisites in the way of tools and appliances will be a carpenter's bench, which may be made as follows: Three pieces of stuff, 2x5 inches and 3 feet long, will serve for supports for the top. Two 12 inch boards, 12 feet long and 1 inch thick, will do for the sides. Nail these side boards firmly to the 2x5 inch cross pieces, and put on a top of suitable material, and the bench is ready for the legs. Now take four pieces of stuff, 2x5 inches, and of the requisite hight for the legs, and frame a piece 1x3 inches across each pair of legs, about 6 inches from the bottom, placing the legs at the distance apart necessary for the width of the bench. Then cut a fork or slit in the top end of each leg, so as to straddle the cross piece at the ends, and put a bolt 3½x⅝ inches through each leg and through the side boards, and the bench will be complete; and it will possess the advantage that it can be taken down in a few minutes by removing the bolts from the legs.

The jack plane is employed for roughing off the surface timber; the stock is made of beech and the blade of cast steel. The blade acts most effectively when it is ground well away toward the corners, thus producing a curved edge, as shown in Fig. 3. When the blade is placed in the stock, and in position to cut off the largest amount of stuff, its

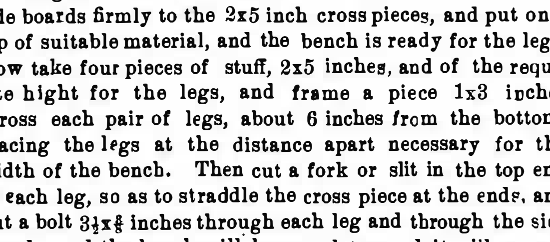

Fig.3.

should protrude through the face of the stock about a sixteenth of an inch, while the corners, A B, are about level with the face of the stock. The beveled face should stand at about an angle of 50° to the flat face. In grinding it, care should be taken to grind it as level as possible, rounding off the corners as shown above. The grindstone should be kept true and liberally supplied with water; the straight face should not be ground away, nor indeed touched upon the stone, except to remove the burr which will sometimes turn over. The pressure with which the blade is held against the grindstone should be slight at and toward the finishing part of the grinding process, so as not to leave a long ragged burr on the end of the blade, as is sure to be the case if much pressure is applied, and it will occur to a slight extent even with the greatest of care. The blade should not be held still upon the grindstone, no matter how true, flat, or smooth the latter may be: but it should be moved back and forth across the width of the stone, which will not only grind the blade bevel even and level, but will also tend to keep the grindstone in good order.

If a grindstone is in excellent condition (that is, true, flat, and level, or slightly rounding), as it should be, it tempts the workman to grind the plane blade with the stone running toward him, as shown in Fig. 4, for the following reasons: If the stone, A, travels in the direction of the arrow, C, the plane blade, B, will relieve the abrasion of the stone

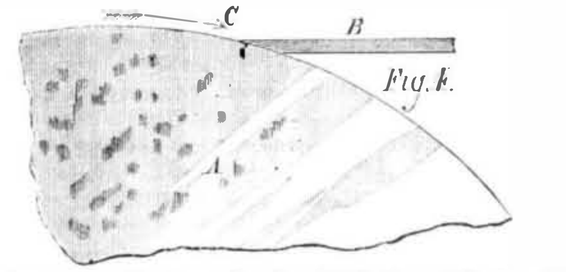

Fig.4.

at the cutting edge first, thus leaving it clean and with no tendency to leave a long ragged edge; but if the blade were held on the other side of the stone, that is to say, with the stone running from the operator, as shown in Fig. 5, the result will be a long ragged edge on the plane blade, especially if much pressure be placed on the blade.

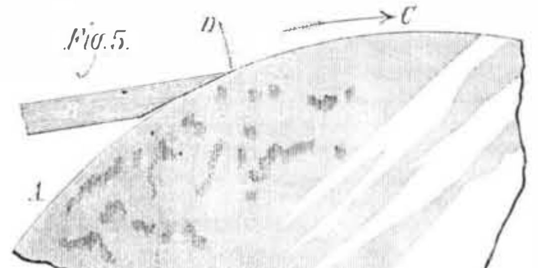

Fig.5.

In Fig. 5, A represents the grindstone, B the plane blade and C the direction in which the grindstone is supposed to revolve: in which case it becomes evident that the plane' blade will receive at its edge some pressure in the direction of the arrow, D; and the metal at the cutting edge of the blade, being very thin, gives way to this pressure and bends back instead of abrading off, leaving a long feather edge, as shown in Fig. 6, from A to B. This edge breaks off in many cases further back than it should do, and inevitably breaks off when the blade is applied to the oilstone, leaving upon the face of the oilstone particles of steel which must be removed before a good edge can be secured to the tool. As a rule, however, this feather edge is broken off by tapping the blade on the palm of the hand, or it may be removed by passing the edge lengthways on a piece of wood. It is,

Fig.6.

however, better to hold the blade as shown in Fig. 3, but there are other considerations which sometimes render this impracticable. For instance, if the stone is not quite true, the high spots will strike against the cutting edge, and render it impossible to hold the blade steadily, and hence impossible to grind it true. If the stone has soft spots in it, as most stones have, the blade will dig in those soft spots, and will also be thrown off the stone when encountering an unusually hard spot. If, in consequence of digging in a soft spot, the blade catches, the cutting edge will be ground completely off; so that it is only under exceptional and unusual circumstances that the blade can be ground in the position shown in Fig. 3. It is better, therefore, to grind it in the position shown in Fig. 4, which is safer and surer. In oilstoning a plane blade, the straight face should be held quite level with the face of the oilstone, so that the cutting edge may not be beveled off. Not much application to the oilstone is necessary to the straight face, because that face is not ground upon the grindstone, and it only requires to have the wire edge or burr removed, leaving an oilstone polish all along the cutting edge. The oilstoning should be performed alternately on the flat and beveled faces, the blade being pressed very lightly on the oilstone toward the last part of the operation, so as to leave as fine a wire edge as possible. The wire is the edge or burr which bends or turns over at the extreme edge of the tool, in consequence of that extreme edge giving way to the pressure of the abrading tool, be it a grindstone or an oilstone. This wire edge is reduced to a minimum by the oilstone, and is then so fine that it is practically of but little account; to remove it, however, the plane blade or iron may be buffed backwards and forwards on the palm of the hand.

The iron being sharpened, we may screw the cover on, adjusting it so that its edge stands a shade below the corners of the iron, and then screwing it tight; the blade or iron and the cover must now be placed in the mouth of the plane stock, and adjusted in the following manner: The plane iron should be passed through the mouth of the stock until as much in depth of it is seen to protrude from the bottom face of the stock as is equal to the thickness of shaving it is intended to cut: to estimate which, place the back end of the plane upon the bench, holding the stock in the left hand with the thumb in the plane mouth, so as to retain the iron and wedge in position, the wedge being turned toward the workman. A glance down the face of the stock will be sufficient to inform the operator how much or how little the cutting edge of the iron protrudes from the face of the plane stock, and hence how thick his shaving will be. When the distance is adjusted as nearly as possible, the wedge may be tightened by a few light blows of the hammer. If, after tightening the wedge, the blade is found to protrude too much, a light blow on the fore end of the top face of the plane will cause it to retire; while a similar blow upon the back end will cause it to advance. In either case the wedge should be tightened by a light blow after it is finally adjusted.