THE STRENGTH OF TIMBER.

BY JOHN ANDERSON, C. E., LL. D., F. R. S. E.

The strength of a piece of timber depends upon the part of the tree from which it is taken. Up to a certain age, the heart of the tree is the best; after that period, it begins to fail gradually. The worst part of a tree is the sap wood, which is next the bark. It is softer than the other parts of the wood, and is liable to premature decay. The deleterious component of the sapwood is absorbed if the tree is allowed to grow for a longer period, and in time the old sapwood becomes proper timber fiber similar to heart wood. Hence, the goodness of a tree, for timber purposes, depends on the age at which the tree was cut down. When young, the heart wood is the best; at maturity, with the exception of the sap wood, the trunk is equally good throughout; and when the tree is allowed to grow too long, the heart wood is the first to show symptoms of weakness, and deteriorates gradually.

The best timber is secured by felling the tree at the age of maturity, which depends on its nature as well as on the soil and climate. The ash, beech, elm, and fir, are generally considered at their best when of 70 or 80 years' growth, and the oak is seldom at its best in less time than 100 years; but much depends on surrounding circumstances. As a rule, trees should not be cut before arriving at maturity, because there is then too much sap wood, and the durability of the timber is much inferior to that of trees felled after they have arrived at their full development.

The strength of many woods is doubled by the process of seasoning, hence it is very thriftless to use timber in a green state, as it is not only weak, but it is exposed to continual change of bulk, form, and stability. After timber is cut, and before it is properly seasoned, the outside is found to crack and to split more than the inside of the mass, because it is more exposed to the desiccating effect of the surrounding atmosphere; but, as the outside dries, the air gradually finds its way to the interior. If timber is cut by the saw when green, and allowed to season or dry in a gradual manner, it is found to be the most durable. In the arts, however, artificial drying is often resorted to, as in the case of gun stocks. These are put into a desiccating chamber, where a current of air at 90° or 100° is passed over them, at such a rate as to change the whole volume of air in the chamber every three minutes, and it is found that a year of seasoning may thus be saved. The walnut wood is as good, after this process, as if the seasoning had been accomplished by time and exposure, and works more smoothly under the cutting instruments of the stock machinery.

Wood will always warp after a fresh surface has been exposed, and will likewise change its form by the presence of any moisture, either from that contained in the atmosphere or from wetting the surface. The effect of moisture on dry wood is to cause the tubular fibers to swell; hence it is that, if a plank or board is wetted upon one side, the fibers there will be distended, and the plank, in consequence, must bend.

The amount of the shrinkage of timber in length, when seasoning, is so inconsiderable that it may in practice be disregarded. But the shrinkage in transverse directions is much greater, and presents some peculiarities which can only be explained by examining the structure of the wood, as resulting from its mode of growth.

Mahogany is a beautiful, close grained wood, but is used not so much on account of its strength, but more frequently because of its non-liability to shrink, warp, or twist, and from the peculiar property of taking a firm hold of glue. In the last respect it is superior to any other wood. Mahogany differs greatly in regard to its closeness, hardness, strength, and beauty. That from Honduras, called "bay wood," is much inferior to that called "Spanish" mahogany, which comes from the West Indies; the former is much used in the construction of light textile machinery, but chiefly on account of its cheapness; and the latter is used for furniture or for other ornamental purposes. As regards strength, this wood is inferior to oak in all respects, and its great characteristic defect is unsuitability for exposure to the weather or, indeed, for any purpose where it is made alternately wet and dry. When so subjected, it rapidly decays, and loses all its good qualities.

Oak, taken as a whole, is one of the strongest and most durable of woods, and is especially adapted for exposure to the weather of a damp climate, and is indeed suitable for almost every purpose where the properties of strength, stiffness, and toughness, combined with endurance, are required. Its value for shipbuilding is proverbial, and in its employment for the staves of casks, for treenails, for carriage wheels, and for all such purposes requiring lightness and strength in combination, it is equally useful. From time immemorial it was esteemed the best timber for heavy roofs, and the condition in which some of these grand old roofs have reached our era fully attests the wisdom of the selection.

Clacking and Over-Reaching in Horses.

Common as are these two faults, they are frequently misunderstood. An over-reach is looked upon as an unavoidable accident, and clacking is treated by irrational alterations of the hind feet shoes. We couple them together because they present some common features. Both consist of interference with the fore foot by the hind one, both are due to some temporary defect in the action, and both can be prevented by altering the form of shoe. Clacking or, as it is sometimes called "forging" is the name given to the sound produced by the hind shoe striking the fore one in progression. It is usually heard at the trot, and seldom noticed in adult horses. It is most common in young horses out of condition and especially noticeable when they are tired. The noise is produced by the hind shoe striking the under surface of the fore one just behind the toe, not at the heels. When the blow has been repeated so as to leave an impression, the marks are found on the inner edge of the fore shoe. This is important, as it shows us that the length of the shoe is not at fault, and it suggests the removal of the part where striking occurs. Removal of this edge is equivalent to making a shoe concave instead of flat on the ground surface, and such a shoe is found to effectually prevent a recurrence of the objectionable noise. The ordinary hunting shoe, especially the narrow one made in a "cress," is the best possible form. For harness horses, where more substance is required for wear, the ordinary shoe seated on the outside instead of the inside is usually sufficient. A case may be met with in which this alteration is not effective. We must then alter the hind shoes, making them square at the toe, with two clips—one on either side—and set back a little on the foot. The wall at the toe should not be rasped off, but allowed to protrude a little. Too often the hind shoes are the first to suffer alteration, sometimes of a very objectionable kind; for instance, we have seen the toe of a hind shoe made diamond shaped and prominent, so as to come in contact with the sole of the forefoot instead of the shoe. This is a most irrational and somewhat dangerous expedient. It leaves the offending part of the fore shoe untouched, and favors the infliction of injury to the foot. Even when the hind shoe is only made short and placed back on the foot, there is a risk of the horn at the toe being unduly worn, and there is a shortening of the leverage of the foot which must more or less affect the powers of progression.

If a horse "clacks," rest contented at first with altering the fore shoes as we have described; improve his condition, and ride him up to the bit, but not past his pace.

"Over-reaching" is an injury to the heel of the fore foot. It is sometimes merely a bruise, but more often a lacerated wound, a small round portion of skin being left hanging, nearly detached from the heel. The offending part of the hind shoe is its inner circumference or edge, so that the injury must be caused by the hind foot being in the heel, and the skin caught as the foot is retracted. The inner edge at the toe of a hind shoe becomes very sharp after a few days' wear, and will cut like a knife. As in "clacking," the indication for prevention is to remove the offending edge. This cannot be thoroughly done with the file, but when the shoe is hot, the edge behind the toe can be cut out with the "fuller" so as to leave the shoe concave. As over-reaching is an accident peculiar to the gallop, it is well always to shoe hunters so as to guard against the occurrence. The neatest and best hind shoe for a hunter is made, like the fore one, in a "cress," and presents a concave ground surface and rounded edges.

When a heel is injured, it is always well to try and save the piece of skin. It should not be cut off until it is certain that it will not reunite to the tissues beneath. One good fomenting on reaching the stable is enough; after that use the simplest water dressing, and under no circumstances use poultices, which only increase the chances of a slough and retard the healing process. Should healing seem slow, apply a mild stimulant, such as a piece of lint wet with a mixture of carbolic acid, one part, to glycerin, twenty parts.

The Decay of Wood.

Wood, being vegetable matter, is of course liable to decay; but how to turn it to the best account with this known attribute to contend with may be worth inquiry. The closer the grain and the heavier the wood, the less liability there is to decay; but for building purposes, as at present carried on, light and open grained woods must be used. We cannot, in these times of excessive competition, go back to the old oak timbered and floored houses of our ancestors. It would, however, pay landlords to build solid, substantial houses, and let them even at the present scale of rental. For instance, in digging away the foundations of the Savoy Palace, built upwards of six centuries ago the oak piles were found perfectly sound, as was the planking which covered the pile heads. But houses are built on a very different principle now, namely, to sell again, and perhaps again, before the permanent owner invests in them, and then a coat of paint and a judicious use of putty cover all imperfections.

The flooring boards, being kept in sheds, present quite a different appearance to the same quality of wood exposed on the quays. Putting on one side the question of expense, the practice of matting up the end of the piles, as practiced in the north of England, cannot be recommended. It certainly preserves the fresh appearance of the wood, and makes it appear as if just discharged from the ship; but it impedes the free circulation of air, and anything that does that is strictly to be avoided. Better by far have the wood shaken at the ends than sweating inside, with here and there places where the penknife blade sinks in with hardly any pressure.

The decay of wood arises from internal and not external moisture; hence the danger of shakes, as they admit it often to the very centre; and so long as free evaporation is allowed, decay will not very readily set in. It would be very absurd to say that no paint ought to be used in the interior of a house, but it is certain that a piece of wood painted on both sides will not last nearly so long as one not painted at all. The reason is evident. The paint effectually closes all the pores and prevents the evaporation of the moisture, which even the best seasoned plank will contain, and hence decay sooner sets in, in one shape or other. For the same reason wood painted on one side only will last longer than that painted on two sides. Thus in an old building, the wainscot, doors, windows, etc. will be found to be affected when the staircases will be sound, because never painted. The old houses in the quaint city of Chester prove the truth of this. Some years ago, a Liverpool builder who had some contracts there told the writer that the numerous exposed beams were generally sound, and they are all unpainted, but the inside work had apparently been renewed. The best that can be done, under all circumstances, is to give a coat of paint before leaving the workshop, and this is generally done, at least in the large establishments.—*Building News.*

Glacier Motion.

"In making some experiments on the freezing of water," says Mr. John Aitken, in *Nature*, "it was noticed that, after the same water had been melted and frozen a number of times, it generally burst the tube in which it was frozen." This phenomenon the author considers to be the germ of glacier motion, and he believes that the ice which has only been frozen once has more air in it than that which has been frozen and melted a number of times; as each succeeding freezing deprived the ice of a quantity of air or some other gases. The natural conclusion seems to be that ice with air in it is a viscous substance, adapting itself to the shape of a containing vessel, though pure ice does not.

In the detailed account of the experiments, we find that rods of snow ice, made in close imitation to the material composing glaciers, bent much more easily, when supported at the ends and acted upon by a weight suspended at the middle, than others made from ice from pure water. Small rods of snow ice, 2 inches in diameter, could be greatly distorted, but when it was attempted to bend them around a small cylinder, by the time the circle was half turned they broke, even under a pressure which they easily bore in the beginning. It was found that the bending of the ice had developed a lamellar structure in it, similar to that found in glaciers, which rendered the beams weaker on account of the cohesion of their particles along, the planes of lamination, rendered less. Hence, further experiment proved that, if a small portion of the circle was bent at a time and the pressure then removed, the particles evidently rearranged themselves; and by continuing the process, a ring of ice was produced from a perfectly straight beam. It is believed that these conditions of alternate rest and pressure, are, in all probability, those which exist in glaciers. After pressure has acted on one part of the glacier, bending takes place, so relieving the ice at that part from the pressure, which comes to bear on another portion of the glacier; and before the pressure again comes to bear on the first part, its strength and viscosity have been resolved by rest.

There are other causes which may assist in producing glacier motion; these are briefly enumerated by the author as follows: The sliding of the ice over its channel, this being assisted by melting of the ice where its rests on its bed; the melting point of the ice, in contact with obstacles, being lowered by the pressure of the mass behind; the melting in the body of the glacier, part of the water finding its way to the channel under the ice and part being refrozen; the crevasses in the glacier (due to the fracture of the ice) enabling large masses to move into different positions more easily, than if the ice were solid; and lastly, the old dilatation theory, which accounts for some of the pressure which causes motion.

Improved Paper Bag Machine.

The paper bag machine invented by Miss M. E. Towne, of Holyoke, Mass., and recently manufactured for the inventor by the Ames Company, is deserving of a more minute description than it has heretofore received. It is a handsomely ornamented structure about 10 feet long and 3½ feet high. The paper enters the machine from a roll, and is at first placed around a form, which can be adjusted so that a bag can be made of any width desired. The paper is worked along by a feeder, and the first process is to paste the bag lengthwise, which is done by a thin wheel rolling upon it, the wheel passing through paste in a dish slightly elevated from the machine. The paper then passes under a knife worked up and down by what is termed a continuous motion and stop motion, and a tucker catches the paper, holding it in position while it is being cut off. There are two small folders which work from each side of the machine, folding the bottom of the bag in the required form, and side arms to bring the paste to the center and paste the bottom of the bag. The bag then passes through a revolving press, which securely fastens the parts already pasted. The last tucker has an up and down motion, and places the last fold on the bottom of the bag, which is pasted by two more side pasters. The bag then passes through two more revolving wheels and is dropped completed

Asbestos.

There are very extensive deposits of this important mineral within the limits of the United States, that found on the eastern slope of the Green Mountains and of the Adirondacks being of the best quality for fineness and tensile strength. The fiber of New York and Vermont asbestos varies in length from two to forty inches and resembles unbleached flax, when found near the surface, but when taken at a greater depth, it is pure white, and very strong and flexible. It is found also, in considerable quantities in the Tyrol, in Hungary, Corsica, and Wales.

MERCURIAL ointment is said to be one of the best materials known for preventing rust on gun barrels. It should be rubbed in thoroughly, both outside and inside, and well dried off, so as to leave but little on the surface. The quicksilver forms a thin film which protects the metal from moisture. The article may be obtained at any drug store.