WOOD-BENDING.

The greater number of articles of bent wood produced by machinery have not been compressed to less than one-twelfth of their original bulk, but, with proper treatment, wood may easily be compressed one-sixth of its bulk in bending, and be in better condition for use. A stick of timber 42 inches long (when straight) and nine inches square, bent over an arc equal to one-fourth of a circle, described by a radius of 12 inches, has its side of the inner curve shortened 14 inches, just one-third of its whole length, and the exact difference in the lengths of the outer and the inner curves proper. The area of the cross section of the timber, multiplied by one-half the amount of reduction in length of the side of the inner curve when there has been no distention, gives, in this case, one-sixth as the amount of compression. Such heavy bending requires the employment of machinery adapted to form the curve, by beginning in the middle of its length and bending both ends toward each other, in order to distribute the compression more equally in all the parts of the length of the wood, which otherwise would be more confined to the parts about the curve proper. The first wood-bending patent granted in the United States was, it is said, for a method of bending heavy timbers for boats and vessels; the mechanical devices employed to contract one side and protect the other, of the "lesser and greater curves" were, and are, common but curious in their application. The preparatory treatment of the wood for bending was peculiar and advantageous, consisting in repeated manipulation and steaming, "to cause more thorough permeation of the steam and heated moisture among the particles of the wood," to soften and qualify it for being bent, before subjecting it to the final process—pressure.

In evidence of the practicability of such wood-bending, heavier timbers are now bent with more success since the employment of machinery adapted to begin the curve in the middle of its length; and the superiority of such bent timbers over those of the natural growth, and those hewn into shape has, after the severest scientific and practical tests, been acknowledged.

The cause of the very limited use at present of such heavy bent timbers, while other timbers are so extensively used, must be attributed to the great cost of the production of such timbers by the use of the present machinery, and not the supposed unfitness of wood to be bent successfully beyond the sizes of timbers and shortness of curves most in common use.

The capability of such woods as are bent into artificial shapes, to be thus treated, is owing to the tenacity of the fibers alone, or a force of compression acting endwise throughout the length of the wood, which in its natural state offers the least resistance, while being bent, to the action of forces tending to compress it endwise. When wood is properly treated for bending, this resistance is lessened and the wood becomes more compressible, and better suited for that permanent compression which is the common effect produced in all wood that is bent and constrained as bent. A stick of wood bent by hand across the knee, or as the archer bends the bow, without any other restraint of tension or force of compression than is afforded by the natural properties and structure of the wood, has the side of its outer curve less elongated than the inner curve becomes shortened; the movement and change of arrangement among the fibers of wood is always more extensive under the effect of compression than under the effect of stretching; and always less hurtful to the structure of the wood whether compression be equally distributed in the length of the wood or not.

It is found in practice that the greatest amount of compression in wood by bending it, is best effected when the slip of the fibers in the whole length of the wood is directed into lines tending toward the desired curve, by forming the wood into a long curve at the outset of the bending process to receive the compressing power, and this, while the long curve is being gradually contracted to the shape of the mold, as the bending advances to completion. The continued steady action of the compressing power upon the wood while it is in the form of a yielding curve, compels the greatest amount of the slip of the fibers, and changes the general structure of the wood from that of the cellular and fibrous to fibrous alone. The friction arising from the slip of the fibers and the crushing of the cells increases the heated condition of the wood, until the process is completed; this favorable effect, together with that of the heated moisture as it is expelled from the crushed cells, and forced more thoroughly among the fibers, softens the wood, reduces the resistance, and facilitates compression to an extent not attained in any method of bending wood that does not begin the curve in the middle of its length.

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The structure and qualities of wood admit of its being bent by any proper machinery that assists compression, and, however, such machinery may accomplish the bending, the effect upon the wood bent is identically the same in every respect and condition, but that of degree or extent.

In regard to any particular method or machinery for bending wood to the best advantage, I have only to add, that an extended effort to learn what had been done and attempted in the art, together with some practical familiarity with it, have suggested the above, under the belief that all wood-bending machinery may very properly be comprised in two general classes; the one, that in which the curve is begun to be formed at one end, and the bending is effected by moving molds; the other, that in which the curve is begun to be formed in the middle, and the bending is effected by other means around stationary molds. The moving molds of the one and the bending from the middle of the other have recently been united, and operated with some success.

JOHN C. MORRIS.

Cincinnati, July, 1859.

PRESERVING AND COLORING WOOD AND MARBLE.

A patent has recently been taken out in England, by W. Clark, embracing the above-named features, and for many purposes the invention appears to be very useful. The wood to be treated is first submitted to an injection of the silicate of zinc in solution, which renders it homogeneous. This silicate is insoluble in acids and mineral salts, and it closes up the pores of the wood. The impregnation by this process is executed in a close and strong iron vessel, and the fluid is forced into the pores of the timber by a pump. The operation is completed when the gage indicates a pressure of 20 atmospheres for soft wood, and 60 for hard wood. The second operation consists in removing the sap of the wood, and for this purpose the patentee employs caustic lye, which permeates the juices of the wood, the application of the lyes and the washing being repeated several times. To obtain delicate colors the wood is made to undergo a bleaching processs after which operation the wood being charged with color acquires light tints and hardness according to the presence of different salts. To preserve woods he removes the sap as above indicated before submitting them to an injection of the sulphate of copper and sulphuret of sodium, the combination resulting from the action of these two substances being insoluble in water. Wood thus prepared is not susceptible of warping or shrinking, and is readily colored. To assist the passage of the liquids injected into the wood, he also employs at one end of the timber an air pump, which also assists the dessication. For coloring marble he employs the same apparatus, but modifies the parts which serve to hold the wood. The marble is submitted to an injection of citric acid diluted in water in order to open the pores. After this operation the marble may be colored.

THE FOUNDATIONS OF HOUSES.

The nature and condition of the soil upon which houses are to be built should receive far more attention than is usually bestowed upon such subjects. A soil which is spongy and damp, or contains much loose organic matter, is generally unhealthy; whereas a dry, porous soil affords a healthy site for buildings. Thus a compact sand and gravel soil, like that upon which the greater part of the city of New York is built, is very favorable to health, because it has sufficient porosity to allow surface-water to penetrate into it, and to carry off organic matter to undergo oxydization without causing malarious vapors. Wherever we find a soil deficient in gravel or sand, or where gravel and sand-beds are underlaid with clay, there should be a thorough sub-soil drainage, because the clay retains the water, and a house built in such a spot would otherwise always be damp and unhealthy.

When the sub-soil is swampy, which is the case with many portions of various cities that have been filled in with what is called *made earth*, fever is liable to prevail in houses built in such localities, owing to the decay of organic matter underneath, and its ascension in the form of gas through the soil. When good drainage cannot be effected in such situations, and it is found necessary to build houses on them, they should all have solid floors of concrete, laid from the outside of the foundations and covering the whole area over which the structure is erected. The old Romans, who were exceedingly sensible persons in all that related to houses, made all their buildings with concrete floors, and over each of these a flooring of tiles was laid. These floors tended to prevent dampness in their houses, consequently they were more comfortable and healthy than they otherwise would have been. Such floors also tended to prevent the cracking of the walls, owing to the solidity and firmness imparted to their foundations. We recommend the general adoption of such floors for all buildings which may be hereafter built on made soil, or in damp situations.

DRAINS AND CESSPOOLS.

It is of the utmost importance to the health of cities that the drains which lead from houses to common sewers should have a pretty good descent, so as to keep them free from being choked up, and to allow of a quick discharge of all matters that flow into them. Sewers should never be built so as to end abruptly at the point of discharge, but should be angled, because the wind is liable sometimes to blow through straight drains, and carry fœted gases up into the buildings.

Cesspools (which are deep holes made below the surface of the ground to receive sediment water) are magazines of filth and storehouses of disease. They generate pestiferous vapors, and should never be allowed near dwelling-houses. In cities and villages where no general system of drainage is carried out, it is not uncommon to find a cesspool built alongside of almost every house, and some have cesspools in their cellars. A cesspool, instead of making a house more dry, as is usually supposed, actually tends to render it more damp, by collecting and retaining the water in a large body. We once saw a church which had a large cesspool made alongside of it, under the pavement, the whole water from the roof being conducted into the cesspool. The basement, which constituted the lecture room, was always exceedingly damp and chilly, but, for years, no one seemed to be able to give a good reason for it. At last one person suggested that the water from the roof should be conducted into the street instead of into the cesspool, and the experiment was tried. The result was most favorable; and the lecture room has now become much more dry and comfortable.

HEAT OF DIFFERENT WOODS.—The following is set down as the relative heating values of different kinds of American wood. Shell-bark hickory being taken as the highest standard, 100; pig-nut hickory, 95; white oak, 84; white ash, 77; dog-wood, 75; scrub oak, 73; white hazel, 72; apple tree, 70; red oak, 69; white beech, 65; black walnut, 65; black birch, 62; yellow oak, 60; hard maple, 59; white elm, 58; red cedar, 56; wild cherry, 55; yellow pine, 54; chesnut, 52; yellow poplar, 52; butternut, 51; white birch, 48; white pine, 42. Some woods are softer and lighter than others; the harder and heavier having their fibers more densely packed together. But the same species of wood may vary in density, according to the conditions of its growth. Those woods which grow in forests, or in rich wet grounds, are less consolidated than such as stand in open fields, or grow slowly upon dry, barren soils. There are two stages in the burning of wood; in the first the heat comes chiefly from flame, in the second from red-hot coals. Soft woods are much more active in the first stage than hard, and hard woods more active in the second stage than soft. The soft woods burn with a voluminous flame, and leave but little coal, while the hard woods produce less flame and yield a larger mass of coal.

LAKE STEAMERS AND RAILROADS.—The class of elegant steamers that used to be the pride of Lake Ontario is fast disappearing from its waters. The *Buffalo Republican* states that the amount of steamboat property ruined by railroads is enormous, and that no less than three or four of the finest boats on Lake Ontario have been sent down to the Atlantic coast this spring, never to return.

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