Properties of Fuel—Wood.

The wood we burn is composed chiefly of three elements, oxygen, hydrogen, and carbon, in various proportions. Of these, oxygen adds nothing whatever to its value as fuel: that depends upon the other elements; hence, the more oxygen, the less there can be of the other substances, and the poorer the wood. Oxygen and hydrogen are both gases. Neither has ever been liquified or solidified. Carbon on the other hand, is a constant solid, and it is this property that makes our fires stationary. When wood is newly cut, it contains from twenty to fifty per cent. of sap or water, the quantity varying with the kind of wood, and with the season of the year. Exposed to air for a year, wood becomes air-dried, and parts with about half its water; fifteen per cent. more may be expelled by artificial heat; but before it looses all its moisture, it begins to decompose or char. The presence of water in fuel therefore diminishes its value as such in two ways; it hinders and delays combustion, and wastes heat by evaporation. If one hundred pounds of wood contain thirty pounds of water, there is left but seventy pounds of combustive material. In the process of burning, one pound will be expended in raising the temperature of the inherent water to the boiling point, and six more in converting it into vapor, making a loss of seven pounds of real fuel, or seven-tenths of the entire combustive force. Besides this dead loss of about ten per cent. of fuel, the water present is an annoyance, by hindering free and rapid combustion Equal weights of different varieties of wood in similar conditions produce equal quantities of heat, but it will not do to purchase wood by weight, owing to the varying quantities of its moisture. It is usually sold by measure, but even equal bulks will be found to vary in this latter respect, as much as equal weights. A series of careful experiments conducted by Prof. M. Bell, has been tabulated as follows, showing the heating values per cord of several American woods—shell-bark hickory being taken as the standard, and marked 100.—

Shell bark Hickory	100
Pignut "	95
White Oak	82
White Ash	77
Dogwood	75
Scrub Oak	73
Witch Hazel	72
Apple Tree	70
Red Oak	69
White Beech	65
Black Walnut	65
Black Birch	63
Yellow Oak	60
Hard Maple	60
White Elm	58
Red Cedar	56
Wild Cherry	55
Yellow Pine	54
Soft Maple	54
Chestnut	52
Yellow Poplar	52
Butternut	51
White Birch	48
White Pine	42

The hardness of wood depends upon the density of its fibres, or rather of their packing. The same species of wood is not always of equal density. Those trees which grow in the forest, or on low wet lands, are not nearly so consolidated as their confreres in the open fields or on barren soils, where growth is slow and retarded.

During the process of combustion, heat is evolved in two ways; first by flame, second by red-hot coals. Soft woods are much more active in the first stage than hard, and hard woods are more active in the second than soft. The soft wood burns rapidly, with a voluminous flame, leaving but little coal; while the hard produces less flame, but yields a larger mass of coal. The cause of this is, partly, the free admission of air through the spongy texture of the soft wood, but it is mainly due to chemical composition. Pure woody fibre (lignin), from whatever source, has the same composition, oxygen 10 parts; hydrogen 10; and carbon 12.—in other words, there is just enough oxygen in it to unite in combustion with the hydrogen and produce water. But in most woods the fibre is impure, especially in the softer kinds. In hard woods, on the other hand, the lignin approaches much nearer the proper chemical combination. In soft woods hydrogen is in excess, hence the vehemence of their combustion at first; more carbon is taken up with the hydrogen, producing flame and smoke, and the coal residue is diminished. It is an error however to suppose that soft wood yields less heat than an equal weight of hard. It burns more quickly, to be sure, but the heat evolved is intense, much more so than that of hard wood in the same time, hence, for rapid and concentrated heat, it is better adapted than the other.

Youmans.

About Lightning-Rods.

From this time till frost comes, look out for the advent of the lightning-rod man. He will call at the house and enquire for the owner, and is never so happy as when informed that he is absent. This gives him an opportunity to scare the women folks, who are very likely to be "afraid of thunder." He will represent the danger of living in a house that has no lightning-rod attached to be so great that they will not "sleep nights" till one is put up. Having talked for an hour, he will leave a tract, half of which is devoted to statistics of mortality from lightning, and the other half to the advantages of the celebrated patent, spiral, tubular, double-and-twisted thunder-exterminator.

He calls again in a week and expresses his surprise that the house is standing and its occupants are alive. The head of the family is ready for a trade, for he fears that the female member of this household will die of fright if the house is not equipped with a lightning-rod before the next thunder cloud appears. He signs a skilfully-worded contract, by the terms of which he obligates himself to pay so much per foot for a sufficient amount of rod to protect the building he occupies. Of course the lightning-rod man being an expert at the business, is constituted sole judge of what length of rod is necessary. He roughly guesses that about fifty feet will be required.

The next visit is for the purpose of putting up the celebrated lightning-demolisher and thunder-tamer. A survey of the house is now made for the purpose of seeing how many feet of rod the signer of the contract can be forced to pay for. You may depend on the lightning rod man to figure this very fine. He understands how to bend the rod round the eaves of the house, how to carry it to the extreme corner, and how to attach it to the most distant chimney He is engaged in selling rods by the yard and he has no notion of disposing of a scant pattern When measured up with all its crooks and turns it is found to be about three times as long as was originally supposed.

If this was the only swindle connected with the transaction there would be less cause of complaint But it is not the only one. The rod is generally sold for four or five times as much as it cost. Most of the claims for the efficiency of the rod, the ability of the point or points to attract lightning, and for its peculiar method of attachment to the building are fraudulent. Some smart fellow got a patent on some particular turn or twist in a piece of fragile metal that could not support itself and used it for the purpose of selling an article almost entirely useless.

Every electrician knows that the fewer turns, twists, curves, angles, and joints there are about a lightning-rod the better it is for the purpose for which it was designed. The truth of the matter is there has been no essential improvement on the original lightning-rod as brought out by Dr. Franklin. That was a straight continuous bar of wrought iron secured to a building by attachments of wood or metal. It was a very inexpensive and simple contrivance, but it conducted electricity better than most of the new-fangled humbugs that have taken its place.

The cheapest way to procure a good lightning-rod is to buy a bar of round iron three-fourths of an inch in diameter and of the requisite length to reach ten feet above the highest point of the roof, to extend over the roof on the most direct line to the ground and to continue into the earth till permanent moisture is reached. This can be secured to the chimney, the roof and walls of the building, by means of iron staples. The tip of the rod should be cut in the form of a screw so as to fit into a polished point that can be obtained in almost any hardware shop. Sometimes points may be obtained that will fit over the end of the rod.

Instead of a round iron bar a strip of iron one inch wide and a fourth of an inch thick, may be used, and in some respects it is superior. This strip may be pierced with holes and tacked directly to the building and chimney, or it may be secured by staples, or by pieces of iron bent over it and secured by screws. Whichever kind of conductor is used, it is advisable to paint it of the same color as the house, so it will not act to disfigure it. The paint will protect it against the action of the air and rain, and will not essentially injure its conducting power.

At present, all persons versed in the laws that regulate the passage of electricity look with disfavor on any attempts to insulate a rod by means of pieces of glass. On the other hand they advise connecting the rod directly with the building, and particularly with metal eave-spouts or other metal surfaces about the exterior of the building. The old idea that electricity only passes over the surface of a substance is abandoned. It is now accepted as a fact that electricity in motion pervades the entire substance of the object through which it passes. This dispenses with the argument in regard to tapes and ribbons of metals as conductors of electricity.

The matter that demands most attention in putting up a lightning-rod is the connection it forms with the earth. This is the thing to which lightning-rod men give the least care, as digging in the hard earth is not the kind of occupation they prefer. It suits their purpose better to sink a crowbar into dry sand and to drop the end of the bar into it. The end of the rod should reach permanent moisture, or else it should extend into a pit filled with charcoal, coke, or scrap iron, either of which constitute very excellent conductors of electricity.—*Chicago Times.*

Good Roofs.

S. E. Todd gave the following information upon this subject at a late meeting of the Farmers' Club of the American Institute. He said: "For several years I have been experimenting with cheap roofing materials. There are about a score of patents for making cheap roofs, the basis of the material being coal tar or pine tar. Hence, if it is desirable to collect the water that falls on roofs into cisterns, the coal tar will taint and color the water to such an extent that it will be unfit for culinary purposes or for live stock to drink. I have tried the asbestos roofing, and can say that if such roofing is put on properly every year, it will prove durable for a lifetime. The same is true of the plastic slate roofing. The numerous failures to make a satisfactory roof with plastic slate and the asbestos material have occurred through the use of unseasoned roof-boards and unsuitable foundation to receive the plastic material. The asbestos roofing consists of cheap and coarse burlaps (very coarse bagging cloth), coated on both sides with a thick coat of coal-tar cement, to both sides of which are pressed firmly roofing-paper, thus making a roll resembling leather. I employed such roofing to cover a lean-to and some bay windows. The roof was perfectly tight until the roof boards began to shrink. In many places the boards shrank to such an extent that the roofing was cracked sufficiently to leak. After the boards had ceased to shrink the leaks were repaired by laying another coat of the roofing on the first coat. But this kind of roofing will require one or two coats of cement every year. About two years ago I covered a new barn in part with the asbestos roofing, and the remainder in the following manner: A roll of burlaps was procured in New York, which cost about 1¼ cents per square foot. After the roof-boards had been on a sufficient length of time to shrink all they would, the burlaps were nailed on with carpet-tacks. It would have been a great improvement if we had placed two thicknesses of newspaper beneath the burlaps to catch the tar. After the burlaps were nailed on, a heavy coat of coal-tar was applied. As soon as the tar had become dry, a plastic covering was prepared by mingling fine sand, sifted, with the coal-tar, until the mass was about the consistency of mortar which is employed for plastering walls. A thin coat of this cement was spread evenly over the tarred burlaps. As I made a mistake of purchasing a quality of burlaps that was judged to be sufficiently firm for the purpose, I found it necessary to nail on another covering of the burlaps, which was tarred and then cemented. By this means the roof was rendered tight. By the application of one coat of coal tar annually, I feel confident that this roof will last as long as the boards on the side of the barn. I have used gypsum (land plaster) to mingle with the coal-tar, and have also employed the regular plastic slate-roofing. But experiment has proved that the finest quality of sifted sand, when mingled with coal-tar, will produce a plastic equal to any other material The cost of good shingles and tin for covering a roof will vary from six to twelve cents per square foot. If one makes a roof of good burlaps of firm quality, or of good gunny cloth (a strong and coarse sacking), and covers it with a coat of coal tar, and then with a coat of tar and fine sand spread on with a plastering trowel, he will have a cheap and durable roof that will cost, in the vicinity of New York, not over two cents per square foot, besides the labor of putting it on, which will not exceed half a cent per foot.

Doing up Fleeces.

The following on doing up fleeces gives the best directions for the work. It is from the *Michigan Farmer*:— The wool buyers prefer to have the fleece loose, light to handle and elastic. In Ohio, the wools of which State are always quoted from two to three cents higher than Michigan wools of the same quality, the fleeces are rolled up, not packed, and tied across twice one way and once the other, and hence are loose, light and elastic. A Jackson buyer, well known, who buys large amounts of wool both in Michigan and Ohio, every year, tells us that he can afford to give two or three cents more per pound for the wools he buys in Ohio than those he purchases in this State, solely because of the difference in the tying up in the two States; as he can get more in the eastern market for wools that are put up in Ohio than he can for the Michigan wools, and when, in fact, the Michigan wools are sometimes the best in quality. The proper way, he says, is to lay the fleece on the table, turn in the head, tail and flanks, and roll it up, commencing at the tail end, tying it with two strings to keep the roll in place, and then with one string across the ends. This is sufficient. A fleece thus tied is light, easily handled and examined, and can be felt all through. It does not need a very thorough examination to determine whether there is anything in it that is not wool."