Free Canals and Canal Improvements.

One of the notable features of the recent election in this State was the enormous vote in favor of entirely abolishing tolls on the State canals. For a long time the great food staples and some other commodities have been on the free list, and latterly all the West bound freight has been exempt from tolls. Under the new law the Erie Canal and its tributaries will constitute a free waterway the whole length of the State, from the Hudson River to the Great Lakes, for eight months of the year. The canals give employment to about 6,000 boats.

The object of the abolition of tolls is to increase the traffic of the canals, so as to make them a more potent factor in solving transportation problems, and in helping to maintain the commercial supremacy of New York. How far the end aimed at will be furthered by the change remains to be seen. The inability of the canals to be the dominant factor in controlling the charge for transportation across the State, and in determining the course of trade in competition with railways, however, would appear to be due less to the amount of tolls hitherto demanded, than to the inability of the canals to meet promptly and parallel the improvements in transportation introduced by the railways. In carrying capacity and economy in transportation the railways are progressive, while the canals are, or have been, practically stationary.

As Mr. Robert Taylor, of this city, has pointed out, the Erie canal boat, towed by two horses, and the 20-car wheat train hauled by a 30-ton locomotive, were for many years equivalent units in wheat transporting capacity, with the advantage of greater economy in favor of the canal.

"So long as this continued, the canal was the regulator of grain freight rates, but as the volume of grain transportation increased, railway improvement was stimulated, and the advent of heavy steel rails suggested better ballasting of the road bed and heavier and closer laid ties. Then came the 70-ton Mogul locomotives, which could fairly fly with forty cars, each containing 500 bushels of wheat—a train load of 20,000 bushels—when the railroad became the regulator of grain freight rates, being able to carry at much lower prices than the canal could possibly carry at, even at 2½ cents, if necessary, and make money."

To raise the canals to their old commercial rank two things are proposed. One is to make the Erie Canal throughout a ship canal, a costly undertaking, and one that might prove the reverse of beneficial either to New York or to the cities along the line of the canal, as the actual benefit of the change would fall rather to the producers and shippers of the far West than to the people of New York.

Another and more reasonable proposition is to increase the carrying capacity of the canal by improving the existing lock gates. The old fashioned, slow moving swinging gates are still used. By a change to lift gates, which could be done without great expense, the available length of the locks would be increased by 35 feet, and the canal boats might be made 130 feet long instead of 97 feet as now, with a proportional increase in their carrying capacity, or from eight thousand to ten or eleven thousand bushels of wheat. The cost of operating the larger boats would be little, if any, greater than for the boats now in use. With improved lock gates, it is further claimed, the carrying capacity of the canal might be five times what it ever has been.

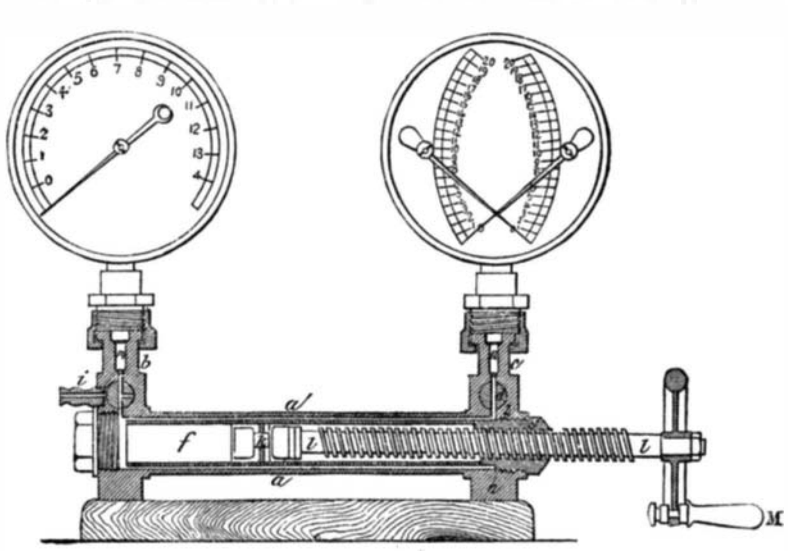
Touching the proposition to abandon the canals entirely as having outlived their period of economical usefulness, it is urged that water carriage remains, and is likely always to remain an important commercial factor, even where railroads are most abundantly developed. Proof of this is seen in the large use of the great canals of England and Scotland, and in the efforts which the more advanced European states are making to extend their facilities for water carriage. Thus in France 74 per cent of the domestic commerce of the country goes over the canals, and efforts are making to largely increase the capacity of such artificial waterways. Germany, likewise, has entered upon the work of enlarging and improving the 2,000 miles of canals within the limits of the empire, and Holland and other states are spending large sums for a like purpose.

A FLAGEOLET player charmed all his hearers by his musical performances at Neuilly, near Paris. He had formerly suffered from diphtheria. Tracheotomy was performed, and the silver tube which was introduced at the time of the operation, and kept stationary by means of a circular pad, now serves the musician of Neuilly as a natural aperture through which he breathes, and so successfully that his flageolet playing was enthusiastically applauded by all present.—*British Medical Journal.*

APPARATUS FOR TESTING PRESSURE GAUGES.

The accompanying cut represents a small portable apparatus designed to test pressure gauges, and which is the invention of Mr. C. D. Gäbler, of Hamburg.

It consists of a brass cylinder, *a*, with tubes, *b* and *c*, provided with cocks, *d* and *e*. In the interior of this cylinder there is fixed, by means of a screw, *g*, a small pump chamber, *f*, in which moves a piston, *k*, actuated by a screw, *l*, with winch, M. When it is desired to use the apparatus, the gauge to be tested and a standard apparatus are connected with the cocks, *d* and *e*, as shown in the cut. But the apparatus must first be prepared by adapting to the tube, *i*, a piece of rubber tubing whose other extremity dips into a glass of water. The conduits, *n* and *m*, are then closed by means of the cocks, *d* and *e*, the latter, which is a three-way one, being turned so as to admit water through the tube, *i*.



APPARATUS FOR TESTING PRESSURE GAUGES.

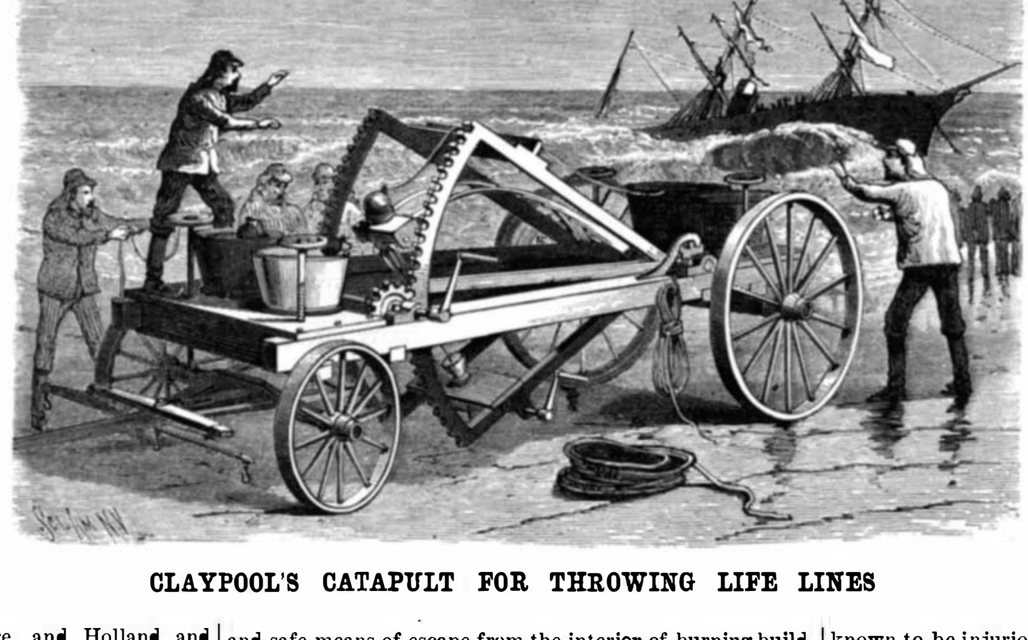
The piston, *k*, is afterward led, by means of the screw, *l*, to the extremity of its travel, and the inner cylinder is filled with water. Then the cocks, *d* and *e*, are opened so as to allow the air to be disengaged, and the piston is gradually pushed in, so that the water shall rise above the tubes, *b* and *c*. The cocks are then closed, and the piston is withdrawn, so that the apparatus is entirely full of water. The two gauges can now be fixed to the apparatus. It is evident that on driving the piston forward the two gauges will be submitted to pressure, and that they may be easily compared in measure as the pressure rises.

For testing barometers, the operations are the same, save that the piston must be driven into the cylinder when the barometers are affixed to the apparatus. When the piston is withdrawn, a vacuum is created. It has been found that on maneuvering the piston twice in succession, care being taken to place the cock, *c* and *d*, properly, an almost perfect vacuum may be produced.

This apparatus has been devised for shops, and, as it is very portable, and takes up but little room, it is capable of rendering service to inspectors of boilers.

CATAPULT FOR THROWING LIFE LINES.

This apparatus is designed for affording a sure, speedy, and safe means of escape from the interior of burning buildings, from sinking vessels, and other places of danger. As shown in the engraving, the apparatus is supported by four wheels like an ordinary wagon. It is provided with a very strong frame, upon which is mounted sector wheels, which are moved by a pinion on the crank shaft, to adjust the elevation of the powerful compound springs mounted on a frame of which the sector wheels form a part. These springs are fixed at their larger ends to the frame near the pivot of the sector wheels, and their free ends are connected by a cross bar carrying a cup which receives the ball attached to the line to be thrown.



CLAYPOOL'S CATAPULT FOR THROWING LIFE LINES

On the lower part of the bar to which the cup is attached is fixed a hook which is caught by nippers attached to a rope wound on a windlass journaled on the lower arms of the sector wheels. The rope is wound through a funnel which serves to trip the nippers and release the springs when it is desired to project the ball.

That part of the frame not occupied by the gearing, sector wheels and springs is floored over, and at convenient places thereon are placed coils of lines or ropes with balls attached in light movable cans with flaring sides, the line to be first thrown being placed on the rear of the frame in the center. In diagonally opposite corners of the frame are embedded four levels, two in each corner, and its frame can be made level by means of the leveling screws passing through nuts in each corner of the frame, whatever be the inequalities of the surface on which the wheels rest.

In practice the apparatus is kept in readiness for removal at an instant's notice, with the sector wheels elevated as far as possible and made stationary, the nippers caught on the hook at the end of the springs, and the rope held taut by the windlass. Having been rapidly hauled to the scene of operations, the apparatus is turned with the rear toward the place where the danger is. The apparatus can be then turned or aimed in any direction by simply backing the horses. The direction having been obtained, the frame is rapidly leveled by means of the leveling screws, the desired elevation obtained by the gearing operating in the sector wheels, the ball to which the line is attached placed in the cup, and the springs brought down by the rope and windlass till they are loosed by the nippers being drawn into the funnel, when the ball carrying the line will be thrown to the desired place.

Should it be desired to reach more than one point, any number of lines which may be prepared could be thrown by removing the can containing the line first thrown and replacing it by another.

Seats may be arranged on the frame for the entire crew needed to manage the apparatus, three men being all that is required—one driver and two to manage the apparatus. Such a crew, with practice, would become so skillful that within a few minutes of its arrival at the scene of danger it could throw a line into any specified window or aperture of any building, or over any building or vessel, and thus provide a means of escape. Further information may be obtained by addressing the inventor, Philip W. Claypool, Summitville, Col.

Absorption of Moisture by Building Materials.

Every one connected with buildings of brick and stone knows the absorbent nature of those materials under the most favorable circumstances. It would astonish most people, adds the *Building News* (London), to be told what a large quantity of water is stored in the brick walls of an ordinary house after a heavy rainfall; the drying or evaporation of which must take place inside in cold weather, unless proper precautions are taken to render the walls impenetrable. The plea for hollow walls has been raised again and again in this journal, and though the system is coming to be adopted more generally in some districts, the idea of solidity of wall structure seems to have taken too deep a hold on the ordinary building mind to be given up. Some time ago a suggestion was made that colliery owners, and others who have large quantities of slag, might with profit utilize this material for building cottages and other purposes. We are not sure whether the hint was taken, but in some parts of the country the material furnishes an admirable aggregate for concrete. Where good aggregates exist like slag, broken brick, sandstone, or furnace ashes, concrete building ought to be much cheaper than brick, as no skilled labor is required.

There is another consideration besides cost which tells in favor of concrete, and that is the non-porosity of walls so constructed. Not only does brick absorb moisture in wet weather, but it is now known to absorb animal gases as well; and here we have a condition which builders of our hospitals and infirmaries ought to be reminded of. We are not sure if concrete has been applied to any buildings in England of this kind on a large scale, but as absorbent walls are known to be injurious in harboring the germs of infection, the value of walls constructed of concrete, made of burnt aggregates, cannot be overrated. Slag-made concrete has the great advantage of being fire resisting, the material in its rough state having been subjected to intense heat. There is nothing in it to "kill" the cement, and the rough surface of walls built with it becomes an excellent "key" for the plastering. In the construction of walls of this material, three sizes of the slag may be used; the larger lumps being packed in layers in the middle of the wall, and the other two sizes, the larger of the size of walnuts, run in with cement on each face in the proportion of eight to one.

Slates.

Slate is a metamorphic clay rock, frequently fossiliferous. It is readily divisible into thin plates, and being easily worked and smoothed, is much employed for roofing and in the manufacture of mantels, billiard tables, and other similar objects. In the quarry, the direction of these cleavage planes is usually vertical, or nearly so, but never coincident with those of the beds and joints. The masses are, therefore, removed by cutting trenches in the side of the hill and splitting the rock in vertical layers. As the perpendicular breast becomes too high for convenient working, say 40 feet, a second trench is cut above the first; then a third, and so on.

In the great slate quarries of Ybron, six miles southeast of Bangor, in North Wales, sixteen of these stages are in progress together, the lower ones being gradually widened by the getting of the slates as the upper ones are advanced. In the upper part of the quarry the slates are removed with crowbars; but the slates become harder as they are lower from the surface, and require the use of gunpowder to detach the main masses. The miners engaged in drilling the holes for the powder are suspended by ropes from the upper parts of the rock, and are liable to many and severe accidents. After the slates are detached by powder or otherwise, they consume considerable labor in splitting them with wedges and mallets into marketable sizes and reducing them to the several grades required for roofing and other purposes.

Slate adapted for ordinary economic purposes is not very common. A number of varieties are, however, found in Cornwall, Wales, Scotland, and Ireland, and also on the continent of Europe. Those from the Ardennes, from Angers on the Loire, and from Nassau are largely exported.

In this country, according to the *Glassware Reporter*, Vermont furnishes slates of unsurpassed quality and beauty. Their quarrying and manufacture are beginning to constitute an important feature of national industry, promising large increase in the future. Northampton county, Pa.; the vicinity of Bangor, Maine; Washington county, New York; Hartford county, Maryland; the Huron Mountains, Michigan; and Pike county, Georgia, also furnish supplies of slate.

Of the various kinds of slate, aluminous yields alum; adhesive slate is porous and adheres readily to the tongue; bituminous slate yields coal oil; whet slate has a fine grain and makes hones; hornblende slate, a tough kind, is used for flagging and sidewalks; drawing or graphic slate, a soft kind containing carbon, is used for pencils; polishing slate, which has a peculiarly fine grain, and is found in Bohemia, is used in slips and powder; and clay slate, consisting of alumina and silica, makes a refractory fire brick, from the absence of fluxes.

The slate used in roofing is a thin, riven slab. The upper surface of a slate is called its back, the under surface the bed, the lower edge the tail, and the upper edge the head. The part of each course of slates exposed to view is called the margin of the course, and the width of the margin is called the gauge. The portion hidden from view is called the cover. The bond or lap is the distance which the lower edge of any course overlaps the slates of the second course below, measuring from the nail hole, and may be from two to four inches.

In preparing slates for use, the sides and bottom edges are trimmed, and the nail holes punched as near the head as can be done without risk of breaking the slate, and at a uniform distance from the tail, regard being had to the spring of the laths. Slates are laid on laths, battens, or sheathing, and must break joint. The nails are of copper, zinc, or tinned iron. In England 1,200 slates constitute a thousand, and they vary in size from 1 foot 1 inch in length by 6 inches in breadth to 3 feet in length by 2 feet in breadth. A "thousand" will cover from two to fifteen squares, according to the size of the slates, and will weigh from three-quarters of a ton to six tons on the same basis. Four hundred and eighty of the smallest size will cover a square, and 127 of the medium size (Duchesses) will do the same. The number of nails required to a square varies, the smallest size requiring the most. The smallest size will take 480 nails, and the largest about 250. There are still other sizes sometimes enumerated, such as "small," "plantation," etc.; these range from 11 x 7 inches to 22 x 12. The general dimensions of American roofingslatesare from 14 x 7 inches to 24 x 16 inches. The thickness of slates ranges from three-sixteenths to five-sixteenths of an inch, and their weight from 2·6 to 4·53 pounds per square foot.

A square of slate or slating is 100 superficial feet, that is, a surface 10 lineal feet each way. The pitch of a slate roof should not be less than 1 in height to 4 of length.

Slate is superior to most other articles for roofing purposes, both as to durability, appearance, and capability of resisting moisture. It will imbibe only about one two-hundredth part of its weight of water, while glazed tiles will imbibe one-seventh their weight. Slates are also much lighter. They cannot, of course, be used for flat roofs, or those of very low pitch; they are irreparably injured by fire, and they will not allow of much harsh usage in the shape of heavy treading on them by mechanics or other who require access to roofs on which they are used. They are also more easily displaced by high winds than tin and some other roofing materials, in consequence of the readiness with which the wind can gain entrance at the joints. But from their fine appearance and effectiveness when well laid they have long been and will continue to be extremely popular for roofing purposes.

School slates are made from a fine and soft quality of slate. The great demand for them has led to various improvements in the manner of making and uniting the frames, and to the invention of special machines for this purpose. Slate frames are now generally made with rounded angles, and one invention consists in securing the parts together more firmly by wires entering grooves at the corners, and having bent ends, which are inserted into holes in the side and end pieces.

Artificial slates are prepared by coating the surface of wood or cardboard with a gritty substance, as pulverized emery or pumice, mixed with black size or paint, or the surface is painted black, and dusted with the powder before it becomes dry.

About Poultry.

Among the multifarious letters which we receive daily, the following appeals peculiarly to our sympathies:

Sir: Having several times noticed in your columns advice given to young men who are about to embark in some business enterprise, and having always appreciated the good and sound judgment you have evinced, we apply to you in our own behalf.

Having sufficient capital to go into business of the produce nature, we come to you for counsel concerning the raising of poultry. Which, in your judgment, would be better adapted for the poultry business on a good sized scale—New Jersey or Long Island? Also, what part of either would be best to start in?

Our aim is to raise poultry and send it to this market ready for sale by city dealers. Yours respectfully,

New York, November 10. POULTRY.

No doubt the poultry business is capable of being made a source of profit, though for our own part we confess we have not found it so. We embarked in it on a pretty large scale five or six years ago, and having made careful preparations, we raised the first year about 1,000 first class white Brahma fowls. But just as they had gained perfection, and while the eye was delighted with their beauty and the financial mind calculated that they would sell promptly for about $3 apiece, some egoistic wretch or wretches broke into our yards, took off the hinges and hasps of the great gate, and when the sun rose in the morning, shedding his glorious light over the whole face of nature, some 500 or 600 of our choicest pullets had disappeared, whither we knew not; and thus the profits of the year were much reduced.

All this happened on Long Island, and therefore our advice to our correspondents would be either to avoid that locality altogether, or at any rate not to plant their poultry breeding establishment too near the Sound, where a swift sail boat or steam launch may afford facility for the escape of plunderers with their booty.

And yet the soil, the air, the sunshine, the grass, and the water of Long Island are exceedingly favorable to the production of good poultry; and, on the whole, our advice to our friends would be rather to take Plymouth Rocks instead of Brahmas, Langshans, Crèvecœurs, or any other fancy variety. Game fowls are very good to eat, but there is not much flesh on their slender and steely bones, and at the same time Mr. Bergh, with his vigilant care of the public morals, will not tolerate any of the profits which might be derived from cock fighting. Leghorns are undoubtedly very productive of eggs; but the mischief of it is that they do not lay their eggs at times when eggs are most wanted, and some of our friends who have been led into the cultivation of Leghorns, through a mistaken faith in their ovarian capacities, have been sadly disappointed, and have got neither eggs nor chickens. Alas, alas!

The feeding of poultry is an important matter, requiring both scientific knowledge and artistic skill. The main thing in a proper gallinaceous diet is undoubtedly grain; and cracked corn, wheat screenings, Indian meal, and wheaten bran are eminently useful. But there must also be a supply of green food, and in summer, grass, and in winter, boiled potatoes and other vegetables, are indispensable to the health of fowls. At the same time they must have a due proportion of flesh meat suitably cooked; and in this way pork scraps are convenient. Their drinking water must be good and clean, not icy cold in winter, nor heated by the direct rays of the sun in summer. It is dangerous to give them drink on which the sun has shed his full force in July or August.

New Jersey is also a pretty good country for poultry breeding. There are some parts of Monmouth County where the soil is easy of culture, and the presence of great supplies of marl enables the farmer to make his land exceedingly productive. On the other hand, Bergen County is more picturesque, and the lover of mountain scenery will find there much to interest his mind and lift his imagination above the monotony of common life. But in one respect poultry breeding is like virtue—it makes comparatively little difference where it is practiced. The point is to practice it with judgment and perseverance; and, as we have no doubt that our correspondents will exercise these qualities in their new business, we wish them all the success that their industry and their skill may deserve. The same intellectual gifts which make a man a great statesman or a great poet will also make him a great poultry breeder. Our final advice to these young men and to all our other readers is, pay as you go!—*New York Sun.*

M. SPRING (Belgian Academy of Sciences) concludes that the seat of the electricity of storms is not, as generally admitted, in the moist region of the atmosphere, but in the cold and dry superstratum.

Transmission of Work to a Great Distance on an Ordinary Telegraph Wire.

The Electrotechnical Committee of the Exhibition of Electricity at Munich, having requested me to repeat upon a telegraph line the experiments on the transmission of power which I had previously made over great distances, I forwarded to Munich and Miesbach the fine wire machines which I had made use of in my laboratory experiments.

The telegraph line placed at my disposal by the administration of the German telegraphic system had a length of 57 kilometers. It is of galvanized wire 4·5 millimeters in diameter, and since, as a matter of precaution, I did not think fit to make use of the earth, I requested permission to employ a return wire identical with the former. The total length of the line traversed by the current is, therefore, 114 kilometers, and its resistance, on measurement, 950 ohms. The insulation is good, but differs in nothing from that universally employed on all telegraph lines. The two machines, situate the one at Miesbach and the other at Munich, are absolutely identical, and have each a resistance of 470 ohms

The total resistance of the circuit is, therefore, close upon 1,900 ohms. In the first experiment which was made there was immediately obtained at Munich a work of 38 kilogrammeters per second (or about one half horse power), at a speed of 1,500 revolutions per minute.

The generating machine, situate at Miesbach, turned at the rate of 2,200. The two machines being identical, the proportion of the work recovered at Munich to the work expended at Miesbach was, setting aside passive resistance of every kind, $\frac{1500}{2200}$, or more than 60 per cent. The machines employed are of Gramme's "atelier" type, modified according to my calculations.

A heavy rain fell during almost the whole duration of the experiments.

The receiving machine serves at present to feed a waterfall of one meter in width and three in height, by means of a centrifugal pump.

Sparks are scarcely visible on the collectors of the two machines. The heating of the machine is scarcely appreciable after two hours' work.—*M. M. Deprez, in Comptes Rendus.*

Timber for Railroad Uses.

The moisture of the soils in the South, says the *National Car Builder*, is very destructive to woods employed as the bed for railway track, and managers have been troubled to know what is the most economical method for obviating loss resulting from this cause. Creosoting has been resorted to. Several works with large capital have been established in St. Louis for the treatment of wood by the creosote process, and in Texas the treatment has been applied along the lines as construction was pushed forward. This method, however, is considered rather too expensive. Some railway men have concluded that the ailantus and catalpa will prove to be the cheapest and most durable wood for tie and bridge timbers. One company, whose road extends chiefly over prairie lands, is having a large plantation seeded for these trees in equal proportions. Both the catalpa and ailantus are readily propagated from the seed, and bear seed pods abundantly. Another company, whose road enters Texas, is arranging to plant several hundred acres of these trees in that State. Even the Iron Mountain Company, that probably owns more heavily timbered land than any other in the country, has contracted for the cultivation of a catalpa farm near one of its stations in Missouri. On this road are catalpa ties that were laid nearly fifteen years ago and are apparently as sound as ever. It is authenticated that in southern Ohio, where one species of catalpa is indigenous, there are posts and timbers of this wood that have been in the ground a full century and yet show no signs of decay. Although the ailantus is an importation from China, still it and the catalpa seem to find in soils of Missouri, Arkansas, and Texas just what they require to thrive upon.

Weight of Western Men and Women.

During the tenth annual Exhibition of Art and Industry in Cincinnati, which closed October 7, the department of Scientific and Educational Appliances employed a clerk to record the weights of men and women visiting the exhibit of the Howe Scale Company. There were weighed 7,467 men and 14,688 women, the men averaging 154·02 pounds and the women 130·87 pounds. The averages for 20,000 men and women weighed in Boston, in 1864, were: for men 141½ pounds, for women 124½ pounds—or 12·52 pounds and 6·37 pounds less than the corresponding Western averages.

By keeping a special account of the weights of the members of excursion parties from outlying towns in Ohio, Kentucky, Indiana, and Illinois, it was possible to compare the weights of visitors from the country with the averages of the men and women forming the whole number weighed. About nine hundred excursionists in all were weighed. The visitors from Ohio averaged—men 157·38 pounds, women 133·26 pounds; from Southern Indiana and Illinois—men 158·52 pounds, women 133·55 pounds; from Kentucky—men 158·43 pounds, women 133·76 pounds. It will be noticed that the country people considerably exceeded the average weights, the men by about four pounds, the women over two and a half pounds. It would not be safe, however, to infer that the country people as a whole were thus above the average weight, since the more vigorous in their respective localities were more likely than their weaker neighbors to join in such excursions.