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Price 10 cents. For sale by all newsdealers.

THE HUDSON RIVER ICE HARVEST.

So far as thickness of ice is concerned, the crop this year is satisfactory; but the heavy snows that have occurred, accompanied by rain, have formed a thick and tenacious crust upon the surface of the ice, which it is difficult to remove; and the labor involved in the removal forms a serious item in the expense of harvesting.

The entire failure last year of the Hudson ice crop, and the slim supply of the previous year, had the effect to develop and establish in this city quite a number of mechanical ice works. These were able to supply the finest grades of ice to customers at prices but little in excess of those charged for natural ice. The artificial ice when properly made is superior to the native article. In the first place, the water for the artificial product is carefully filtered, and then the freezing is so arranged that clear, transparent, dense ice is produced, which looks better, in fact, is better—as it lasts longer—than the natural ice, the latter having more air locked in it than the artificial.

Again, many establishments which formerly made use of the cheaper grades, such as snow ice, for cooling purposes, having been for two seasons subjected to high prices, have put into use the mechanical refrigerating machines, by which storage cellars and chambers are kept sufficiently cool without the use of ice.

These circumstances have combined to diminish the demand for the natural ice and to render it necessary for the ice men to use more care than ever before to select, prepare and store the clearest and best ice, but at increased expense, as above indicated. The progress of inventive genius is well illustrated in the advances made in the artificial production of ice—advances which promise soon to supersede and beat the severest efforts of Dame Nature.

WOODEN RAILWAY TIES.

The Forestry Division of the United States Agricultural Department has recently made a thorough investigation as to the consumption of timber for railroad ties and the effect of such consumption upon the forestry interests of the country. The investigation included a discussion of the various methods in use for the preservation of tie timber as well as an exhaustive statement of the progress which has been made in substituting metal for ties of wood.

The results of this investigation are most interesting and valuable, as every phase of the subject has been fully covered. The consumption of timber for railroad uses is placed at twenty per cent of the total supply, and B. E. Fernow, chief of the Forestry Division, who superintended the gathering of the statistics, says that the tie timber is now largely composed of the thrifty young growth, the promise of the future, and thus the amount of timber produced to the acre is greatly reduced. The most durable and valuable timbers only are desired, and by subjecting forests to the thinning out process necessary to find desirable tie timber, they deteriorate. Mr. Fernow instances the case of Kentucky forests, where oak represents forty per cent of the natural growth after it has been culled—mostly for railroad purposes—the new growth contains not more than five per cent of this most valuable timber.

The destructive effects upon the forests of the present demand for tie timber is shown by the fact that this material is now largely cut from trees that will make only one tie, or, at least, only one tie from a cut.

The annual consumption of railroad ties is placed at 73,000,000, which requires 365,000,000 cu. ft. of raw material. Mr. Fernow states that the opinion generally held by railway managers that young wood is more desirable because it is young is erroneous. "On the contrary," he says, "young wood, which contains a large amount of albuminates, the food of the fungi, is more apt to decay, other things being equal. Sound, mature, well grown trees yield more durable timber than very young or very old trees."

It has been found that hewn ties will last from one to three years longer than sawn, and the explanation is given that the sawn face is more or less rough and collects the water and thus gives opportunity for fungus growth, while the smoother face of the hewn tie sheds the water. The life of tie timber, which is a most important factor in considering the relative advantages of wood and metal, is affected by the breaking of the wood fiber by the flange of the rail and by the spikes.

Another cause of the shortening of the life of the tie is rot or decay, due to a fungus growth. These elements of destruction are accelerated or retarded by the condition of the road bed. When the New York and New Haven Railroad a few years ago adopted stone ballast for their track, it was supposed that the life of the chestnut ties, which are used, would be greatly extended. It has been found, however, that with the high rate of speed of trains and weight of engines the ties don't last more than five years, the cutting of the rail on the upper and the stone on the lower side wearing them out rapidly. Ties are less liable to rot on stone ballasted roads, but even the oak ties which the Erie road uses are worn out on the heavily used portions of the road before they rot.

The following table shows the age of ties of different kinds of wood, and was made up from reports received from 283 railroad companies:

Kind.	Range.	Average.
Conifers:		
Redwood	8-15	11-12
Bald cypress	4-12	8-10
Red cedar	....	10
Tamarack	4-12	7- 8
White cedar	4-10	7
Pine, long leaf	5-10	6- 7
Pine, red and white	4- 8	6
Pine, bull (California)	6- 9	6- 7
Pine, bull (Colorado)	3- 6	5
Hemlock	2- 8	4- 6
Spruce	3- 7	5
Broad-leaved trees:		
White oaks	3-12	7- 8
Chestnut	4-12	7- 8
Honey locust	....	10
Coffee tree	7-10	....
Cherry, black walnut, locust, sassafras	6-10	7
Mulberry	5- 6	6
* Mesquite	...	...
Elm	4- 9	6- 7
Black oaks	2- 7	4- 5
Ash, beech, maple	2- 7	4

* The life of mesquite, if sound, is claimed to be interminable.

"The common spike, now almost exclusively in use," says Mr. Fernow, "must be considered the poorest and most unsatisfactory part of our railroad construction. Not only is a large part of the reduction in the life of railroad ties to be charged to these imperfect fastenings, but they are probably responsible for more damage to rails and rolling stock and for more accidents than is generally recognized. An improvement, therefore, in rail fastenings is decidedly needed."

It has been found that by the use of bed plates the life of ties can be greatly extended, as they give a more even distribution of rail pressure over a greater area of the tie, thus retarding the destruction of the tie by cutting, preventing the lateral bending of spikes or screws, and thereby loosening the rail. Mr. Fernow commends the bed plate designed by Mr. Post, the engineer of the Netherlands railroad.

While the attention of railroad managers has been directed to preventing the rapid destruction of the tie by mechanical processes, they have also adopted means to preserve it against rot. In France not a tie is put down without its being first subjected to a preserving process. The same practice prevails in Europe generally, though little use has so far been made of the process in this country.

As the rapid destruction of our forests is clearly shown in this report, as it has been elsewhere, the adoption of the best method of treating railroad building material so that the utmost service can be obtained from it becomes a vitally important factor in the question of forest preservation. Most of the processes now in use for preserving wood are based upon the idea of eliminating the sap of the wood, and substituting in part, at least, an antiseptic which is to keep out moisture and to make the germination of fungi impossible. The vulcanizing process has been in use on the elevated railroad lines in New York City for the past six years, and Col. Hain, the manager, says that yellow pine timber thus treated after six years shows no rot and hardly any wear by cutting, whereas untreated timber rapidly decayed. The vulcanizing process consists in subjecting unseasoned wood to dry air heated to from 400 to 600 deg. F., under pressure of 100 to 175 pounds per square inch, heat and pressure being regulated according to the nature of the timber and the result to be obtained.

Heavy oil of tar, commonly called creosote, and also the chloride of zinc are used for preserving timber. The latter process is called burnettizing, and it is claimed that by its use the life of a hemlock tie, which ordinarily is three years, can be extended to sixteen years.

Barometric Plants.

The *Petit Traité de Meteorologie Agricole*, by Mr. Cana, contains a list of prognostics *apropos* of the aspect that certain plants present according to the state of the atmosphere. The following are a few examples: If the head of the gith (*Nigalla sativa*) droops, it will be warm; if the head of the same plant stands upright, it will be cool; if the stalks of clover and other leguminous plants stand upright, there will be rain; if the leaf of the wood sorrel turns up, it is a sign of a storm; if the leaf of the whitlow grass slowly bends up, there will be a storm; if the flower of the convolvulus closes, it will rain; if the flower of the pimpernel closes, it will rain; if the flower of the hibiscus closes, it will rain; if the flower of the sorrel opens, it will be fine weather; if the flower of the same plant closes, it will rain; if the flowers of the carline thistle close, there will be a storm; if the flower of the lettuce expands, it will rain; if the flower of the small bindweed closes, look out for rain; if the flower of the pitcher plant turns upside down, it will rain; but, if it stands erect, it will be fine weather; if the flower of the cinque foil expands, there will be rain; but, if it closes, the weather will be fair; if the flowers of the African marigold close, it will rain; if the scales of the teasel became close pressed against each other, it will rain.

A Great Engineering Work in India.

The southern extremity of the peninsula of India consists of a broad plain, flanked on the west by the narrow mountainous kingdom of Travancore. In this plain the district of Madura has one large stream, the Veigei, which rises on the precipitous eastern slopes of the Travancore mountains, and, tumbling down into the plain, flows slowly along its sandy bed until it empties into the sea on the east. It often does not reach the sea, for the rainfall is so slight and its waters are drawn off into so many channels and tanks that it has to be in flood to ever reach its mouth.

On the other hand, there are streams in those same mountains of Travancore that rise at a higher elevation than the Veigei, and not very far from it, being separated only by a mural precipice, and yet flow westward through the narrow Travancore country, and pour their volume of fresh water into the sea without doing much good to man. Besides this, the rainfall is very heavy in that region, and the land does not need the water thus carried into the sea.

The benefits that would accrue to Madura could one of those streams be turned eastward, without inflicting any injury to Travancore, were recognized more than two centuries ago by the Hindoo rulers of Madura. The stream nearest to the border, and at the same time the largest of the Travancore rivers, is the Periar.

In 1798 the prime minister of the kingdom of Ramnad, in the eastern part of Madura, is said to have sent some intelligent native officials to examine into the practicability of opening a channel for turning the Periar into the Veigei. They reported that the construction of a dam would secure an abundant supply of water to all the districts through which the Veigei flows.

In 1807 and 1808 two English officials explored the jungles of those regions and declared the scheme impracticable. So nothing was done until 1861, when Captain Ryves explored a portion of the course of the Periar and reported that that stream could be diverted at a reasonable cost. Other engineers seconded his proposals. So in 1867, the government passed an order directing a new survey of the course of the river within the region to be affected.

Two years ago Col. Pennycuick, now the chief engineer under the Madras government, took up the work with such zeal and enthusiasm as to set it in actual operation and make it a probable reality within the next decade.

He chose a site for the dam seven miles below the original site chosen. It is in a deep valley, narrowed by two knolls that push out from the mountain ridges of the sides. The river runs due west at this place, and the south knoll is 150 feet high, which is just the intended height of the dam, but its connection with the mountain beyond is by a saddle 40 feet lower than itself, so that the dam will have to be thrown across the depression. The north bank rises 250 feet from the stream, and its connection with the mountain on that side is also depressed, but not to the level of the dam. And right here the engineers are cutting down the ridge for an escape when the water rises abnormally high.

The dam itself is to be 150 feet high, 60 feet wide at the base, tapering to a width of 15 feet at the top, and as long as may be necessary to plant it firmly on the bed rock on either side. This rock is not found as near the surface of the hillsides as was expected, and the engineers are in a state of some anxiety as to how deep it will be necessary to excavate in order to find it. The construction of the dam will be thin walls of stone on the outer sides, filled in with a great mass of cement for the body of the dam.

By this dam the waters will be raised so as to flow back over the course of the river some ten miles. And at a point northward seven miles away they will fill the valley inclosed by the mural precipice overlooking the plains of Madura. This rocky wall will be pierced by a tunnel 5,700 feet in length and about 7 by 10 feet in diameter.

Already a perpendicular shaft has been sunk 100 feet at the upper end and the boring carried on for 200 feet, while at the lower end the tunnel is 800 feet in length. In order to check the force of the water at the perpendicular shaft a circular tunnel has been cut at the junction of the shaft and the tunnel.

At the dam 44 feet of the outer stone wall has been built up, extending across the stream and raising the water 12 feet. Below, the wall is progressing, and it will soon be ready for its filling of cement. At the same time hundreds of coolies are cutting down the banks. The stone is brought down from the cutting for the water escape above, where four stone crushers are at work. A gravity railway carries the loaded trucks down the long incline. On the banks of the stream a machine shop has been erected and a turbine wheel set in place, to be worked by the water, that will have an increasing fall as the dam rises.

Already the water has been set back two miles, and a beautiful narrow lake formed to that extent.

The force of Europeans in charge comprises a superintending engineer, an executive engineer, two subdivisional engineers, and a young man in charge of the plant.

One of the subdivisional engineers resides at the tunnel works, the others at the dam, having their residences on the knoll of the north bank that overlooks the dam.

Under them are 1,000 coolies at the tunnel and 1,700 at the dam. These comprise Eurasians, Portuguese, Mussulmans, Malayalees, Tamils, speaking many different languages.

Then there is a military squad of 200 pioneers of the Madras army, under the command of their affable commander, Major Fenwick, an Englishman. These men do the same work as others, and after a short period of service will be sent back to be replaced by others, that they may be accustomed to such work.

Cooly power, water power, ox power, elephant power, compressed air power, and steam power, are all in active operation.

Twenty lacs of rupees (Rs. 2,000,000) have already been spent, and the estimated cost is from 60 to 70 lacs, but it will undoubtedly foot up 100 lacs ($4,000,000) before it is finished.

The coolies are congregated in two great settlements, which are lighted with street lamps. The Mussulmans have a square platform, with flags above, for their place of worship, the Hindoos a couple of rounded upright stones, and the Christians a thatch chapel.

It is a feverish region, and the services of the medical assistant are in constant requisition. And the malaria is so virulent from March to June as to stop all work in those months.

But when accomplished it will bring life and verdure to a land now smitten with drought and poverty.

In addition to work on the mountains, a long and broad channel is under construction to carry the surplus water a distance of 38 miles to the northern part of Madura District, where the supply of water is most deficient. In connection with this large channel are many smaller distributing channels to carry the water supply to as many fields as possible. The artificial reservoirs or tanks that lie in the way of the main channel will be utilized and will become unfailing ponds or lakes. At present they are dry all through the hot season, when their water would be most grateful. Of the 38 miles of channel, 22 are already dug.

There will be bridges to build over the stream that now is fordable, but will then be continually full.

Cyrus turned the waters of Babylon from the Euphrates channel to conquer human foes. The British government is turning this river to conquer famine and starvation and save humanity.

Madura, So. India. JOHN S. CHANDLER.

Completing the St. Clair Tunnel.

The *Railway Review* says: The stone work of the portal of the St. Clair tunnel at each end is now complete. The east portal face is a wall about forty feet high and nearly one hundred and fifty feet long, built of immense blocks of stone, some of which are over a yard square each. In the middle of the wall is the opening of the tunnel, twenty-two feet in diameter. The excavation on the Canadian side is down to the required depth of sixty feet for a small space just at the tunnel portal, and a large force of men is employed enlarging the excavation to the proper width, so that work may be begun at the proposed retaining walls, which will extend east from the portal one thousand and fifty feet. The retaining wall will be of the same ponderous masonry as the portal, and will be further strengthened by anchorage walls extending at right angles into the bank.

Inside the tunnel is just now a busy hive of industry. Tram cars are hurrying back and forth from the portal along the temporary tracks with loads of brick, cement, lumber, rails, and other materials, and the long line of twinkling electric lamps which stretches back from the entrance into the dim vista of the great bore reveals an army of workmen engaged in an apparent chaos of operations—calking, brick laying, excavating, grouting, track making, cementing, pipe fitting, rail laying all going on at once. The seeming confusion, however, explains itself when it is seen that the work of putting in the permanent track is going on from each end toward the middle and that the whole work is being carried on simultaneously, each working party keeping a little ahead of those engaged in the succeeding operation. The iron lining of the tunnel must be thoroughly calked at every point and seamed throughout, to prevent leakage, and this work is almost completed.

The brick bulkheads for the air locks had to be taken out, and this was no small undertaking, for the cement in which the bricks were laid had hardened like flint, and though a force of men has been drilling and sledging at it ever since the compressed air was taken off, much of the brick work of the wall at the Canadian end yet remains to be taken out. For the permanent way the whole tunnel is first lined with brick work laid in cement reaching half way up the sides. A floor of concrete made of Portland cement is next laid in the bottom to make a level bearing for the track. On this floor four lines of timber are laid, as stringers, a pair on each side, close under where are afterward to come the lines of rails. Across the stringers heavy beams are laid four inches or so apart, and screwed down to the stringers with screw bolts. Beams and stringers are of Georgian pine, soaked with creosote to prevent decay.

After the needlebeams are laid, a floor of cement is put in between the ends of the timbers and the wall of the tunnel on each side, to keep the track in place, and to make a foot walk for the employes. On top of the needlebeams are spiked the ponderous rails, one hundred pounds to the yard and thirty feet long, and the track is then complete. In the roof are placed suction pipes communicating with the pumping station, by which the air is pumped out and ventilation is secured, and at intervals along the walls safety ladders like small fire escapes are built into the sides of the tunnel, on which the track walker may take refuge when he chances to meet a train. This work is all well advanced, and when it is finished and the electric light wires put up and proper lamps attached, the tunnel itself will be complete and ready for business.

The St. Clair tunnel extends from the town of Port Huron, Mich., under the St. Clair River, to Sarnia, Canada.

Chiseling Gun Cotton.

Gun cotton, said Professor Munroe, in beginning his lecture on that explosive, at the Lowell Institute, recently, is pure cotton dipped in a mixture of pure nitric and sulphuric acids. In seeking a method by which these ingredients might be obtained absolutely pure and the cotton thoroughly treated with the acids, many years have been spent and serious accidents have occurred.

According to the Boston *Journal of Commerce*, the lecturer traced the experiments with the explosive from its discovery, in 1832, up to the present time, and spoke of several of the most fatal explosions which attended the experimental stage.

After experiments by Professor Hill, of the United States torpedo station, gun cotton was adopted as an explosive for use in the navy in 1884. In preparing it for this service the gun cotton is, by successive pressings in hydraulic presses, the last of which has a pressure of 6,800 pounds to the square inch, made into little blocks measuring 2½ inches each way. It now contains from 10 to 16 per cent of water, but when issued to the service contains 35 per cent. Before being made up into blocks it is carefully tested.

Professor Munroe declared that gun cotton, correctly prepared and handled according to directions, was the safest of the explosives to use. It was dangerous only when the materials had not been thoroughly purified, or the union of acid and cotton incomplete.

In proof of what could be done with it, a picture was thrown upon the screen showing the workman cutting it with chisel, jig saw, and lathe to fit it into a shell. Another illustration was the extinguishing of a block that was burning by pouring water upon it. Two thousand pounds of it had been burned in a bonfire without an explosion.

One volume of the explosive gives 829 of the gas, and the pressure developed by combustion is eighty-one tons to the square inch, and by detonation 157·5 tons, the latter being in contact, however. The effect of the explosion of one particle on another is so rapid that it would take only one second for it to pass through 19,000 feet of the explosive.

It was shown by the stereopticon that the letters U. S. N., with the date of manufacture, that are on the bottom of each block, are impressed upon an iron plate upon which the gun cotton may be exploded. It is a curious fact that, if the marks on the block are in relief, the reproduction on the iron will be raised, and, if cut in, there will be an indentation on the plate. Professor Munroe's theory is that when the letters are cut into the explosive, the gases generated in the indentations are hurled from them as a projectile from a gun. If a leaf or a delicate piece of lace be laid between the gun cotton and the iron, its impress will be left in all the perfection of outline of the original, though the article itself is absolutely annihilated.

WE have received from the United States Iron and Tin Plate Co., Limited, of Demmler, Pa., an ornamental paper weight of sheet tin, on which a poetical effusion is printed, the purport of which is to announce that the manufacture of tin plate has been commenced in this country, and has come to stay. We hope this expectation will be realized; but "one swallow does not make a summer." The consumption of tin in this country is enormous, and it will require many gigantic establishments to supply the demand. The world's product of tin plate is 562,000 tons per annum, of which the United States require 369,000 tons, nearly all of which at present comes from England.

THE harvester trust, whose formation was recently announced, failed to complete a working organization, and the several firms who were to be members will still continue their business as individual enterprises. The trust was to have had a capitalization of $35,000,000, and contemplated the control of the manufacture of all the agricultural machinery in the United States.