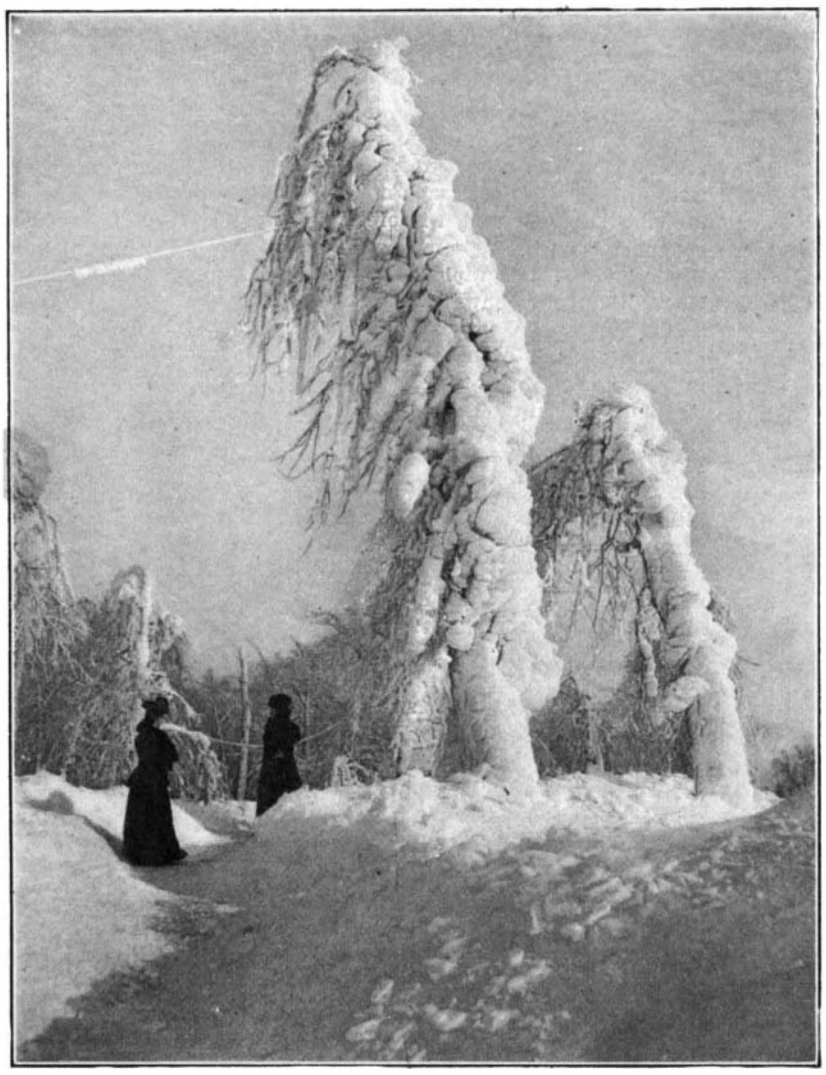
THE ICE CONDITIONS OF NIAGARA RIVER.

BY ORRIN E. DUNLAP.

The ice conditions met at Niagara Falls in the winter season are quite different from those of any other place. This is true not only so far as the scenic feature is concerned, but also in connection with the experience of the great power companies. In the majority of water power developments ice gives more or less trouble, but at Niagara the ice that has to be conquered is the result of unusual conditions that are thoroughly interesting. All of the Niagara power plants have to fight the ice of winter time, and it is a struggle of both night and day. The numerous turbines now in operation at the Falls require quite a large supply of water, and this creates a current in the upper river that sucks the ice toward and into the inlet canals. The larger part of the ice that develops the battle at Niagara is formed many miles away, in Lake Erie, and rushes down the river channels on the rapid current. When the wind is favorable for blowing the ice field of Lake Erie into Buffalo's harbor, it crowds into the entrance of the Niagara River in tremendous quantities, and the entire stream becomes a tumbling, grinding, tossing mass, pushed on by the pressure of the waters behind and pulled forward by the unceasing suction of the great waterfall.

The Canadian side also feels the effect of the flow of ice from Lake Erie, and power and water plants are occasionally interrupted in their operation by the anchor ice. Recently the pumping station of the Niagara Falls, Ont., water works was forced to idleness by the ice, and it was necessary to secure a water supply from the municipal pumping station of Niagara Falls, N. Y. This was accomplished by running a line of hose from a hydrant on the New York side across the upper steel arch bridge to a hydrant on the Canadian side. Through this hose a stream of water was sent until the Canadian plant was able to renew operations.

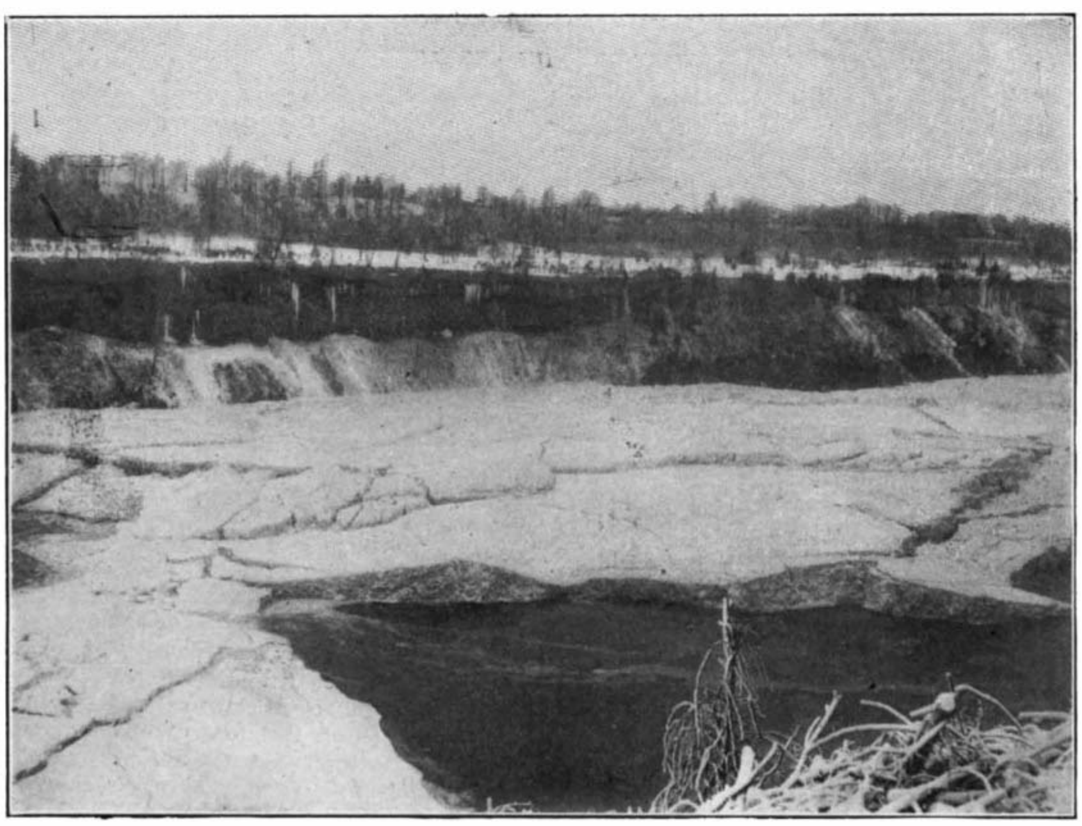
People who live close by rivers and smaller streams are quite accustomed to see them frozen over in winter, but at Niagara a peculiar effect develops when an ice bridge forms in the gorge below the Falls. It is just below the American Falls that the ice bridge usually forms at Niagara, at a point where the water is fully 190 feet deep and the current is quite rapid. The sheet of water does not freeze over like other streams and rivers, but to the contrary, the ice bridge is formed by small pieces of ice gathering in such great numbers that they jam between the two shores so tightly that a mass of great thickness and strength is formed. None of the pieces of ice is much larger than a man's hat, and they are of all shapes. This ice is not formed at the point of gorging, but on the contrary, comes down from Lake Erie. No matter what size the cakes are when they leave the lake and enter the river, in the trip down stream, through the upper rapids and in the terrible drop over the Falls, they are all churned and broken up, so that the ice that comes out from beneath the cataract is all in very small pieces. This ice fills the lower river from shore to shore. It crowds into the eddies, and is jammed tight by the force of the flowing ice pushed on by the current. The eddies become clogged until the only open channel is in midstream, and through this channel the ice pushes and grinds as it is shoved forward by the ice that continues to pour over the precipice. The quantity of the flow increases. The weather grows colder, and it is observed that the ice in the channel in midstream shows a disposition to linger. Then it breaks away again, and the grinding and forcing continue until the quantity of ice coming over the fall becomes too great to pass through the channel, and an ice jam quickly results. Then it rolls and heaves on the river. The pressure behind grows greater, and the mighty mass of quiet ice is heaved mountain high. It is firm. All motion has ceased. An ice bridge is formed—a rough, uneven, rugged mass through which deep crevices extend, affording excellent opportunity to judge of the thickness of the icy structure. At these times the water is unusually high, a condition brought about by the direction of the wind, which forces the lake waters into the river, carrying the ice field with them. When the wind lowers, the water recedes, the ice bridge settles, and becomes practically keyed over the lower river. A change of wind will once more send the water pouring in greater volume from the lake to the river, and a new and possibly greater supply of ice will rush downstream. The ice bridge already formed will act as a dam to its passage, and then, with the pressure of the cataract behind it, the new ice is hurled upon the ice bridge, and there is a wonderful change in its formation. It is made more mountainous, more beautiful, and Niagara is in its full winter glory.



ICE AND SNOW COVERED TREES.

While the Niagara ice bridge shows the power of small cakes of ice when united, the ice mountain of Niagara portrays the building ability of tiny spray drops when caught in the grasp of King Winter. It is truly wonderful to what proportions this ice mountain grows. Its massiveness amazes all who have looked upon it. So great is the quantity of ice it contains, that it is well-nigh midsummer before the last vestige of it leaves the slope close by the American Fall. While the ice mountain decays under the effect of spring sunshine, the vegetation of the bank develops beauty.

The summer foliage of many of the beautiful trees close by the Falls of Niagara would be far more attractive were it not for the fact that each winter the ice that gathers on them breaks off the slender limbs. Trees that stand near Prospect Point in Prospect Park have only trunks and a few limbs, their tops paying penalty to winter's beauty. The same may be said of the trees on Luna Island and some at Terrapin Point, where the ice gathers in great weight. It requires but a few hours to develop a wonderful change in the Niagara scene, and where to-day there is barrenness, to-morrow may be admired as the throne of winter. Occasionally beautiful frost effects may be seen in every piece of woods, but the trees of Niagara become like purest marble when the spray cloud has them within its grasp.



SCENE JUST BELOW THE HORSESHOE FALLS, SHOWING HOW THE THICK ICE IS CROWDED UP ON THE CANADIAN BANK.

Study of Transparent Metallic Films.

The method of producing thin deposits of the metals by cathode projection has been studied by L. Houllevigue, of Paris. It is observed that when a discharge is produced in rarefied gas the substance of the cathode is projected in all directions in the surrounding space. This property has already been utilized to obtain platinum mirrors and resistance strips. The experimenter has produced thin layers of various metals such as platinum, palladium, iron, nickel, copper, and bismuth; no doubt the other metals may be deposited in the same way, but carbon after seven days' discharge gave no deposit. The thin and transparent layers of metal which are deposited upon a glass surface afford an interesting study. To obtain these, a glass plate 2 inches square is placed upon a large horizontal anode plate. Half an inch above it is a horizontal plate of the metal to be deposited, forming the cathode. The whole is placed in a glass recipient and a vacuum made. The discharge is produced as usual by a Ruhmkorff coil, and the dark space surrounding the cathode comes nearly in contact with the glass. The discharge commences by driving out the occluded gases of the metal. This first period is especially long with platinum and palladium. When this is finished the substance of the cathode is driven off, and is deposited partly upon the glass opposite and partly on the metal anode plate. The deposit thus formed on the glass presents all degrees of transparency according to the duration of the discharge, which may last several hours or days. The layers present, especially in the case of copper, the iris reflections which are characteristic of thin deposits. Their reflective power is considerable. The layers do not adhere strongly, but may be easily brushed off the glass.

The study of bismuth and iron in this form when placed in the magnetic field is of especial interest. A film of bismuth obtained by this process was placed perpendicularly in a field of 2,250 units. Contrary to what might be expected, it showed no variation in electric resistance due to the action of the field. Its resistance remained unchanged at 26.9 ohms. Leduc observes that bismuth is more sensitive to the magnetic effect as its structure is more crystalline. It would seem from the above that the bismuth deposited in the thin layer is completely amorphous. A film of transparent iron placed across the magnetic field allowed the rotative effect on polarized light to be easily observed. A variation in the field of 12,250 units caused a positive rotation of 1 deg. 18 min., deducting for the glass support. On the contrary, the author has not succeeded in observing, in a film placed parallel to the magnetic field, the existence of double refraction pointed out by Righi.

One of the latest long-distance and high-speed electric railways is between Seattle and Tacoma.