might remain in one town, and with his battery send a locomotive and train to any distance required.

It would seem from the above that the idea of railway car propulsion by electricity was projected in this country more than thirty years before Mr. Siemens' motor was introduced to the public.

PROF. TICE'S THEORY OF CYCLONES.

In reporting the results of his observations along the track of the tornado which proved so fatally destructive at Marshfield, Missouri, Prof. Tice, of St. Louis, expresses the opinion that all such whirlwinds, so called, are electrical storms, not wind storms. There was, he says, no wind attending the Marshfield tornado. Among the evidence of the electrical nature of that storm he notes the fact that it destroyed every building which had a tin roof or which had any metal of any kind in its roof. In Marshfield, it passed directly over several buildings with shingle roofs, and tore to fragments others, not more exposed, which had metal roofs. A mill, situated over a quarter of a mile away from the center of the cyclone, had its iron chimney torn out and carried a long distance, while the mill itself suffered very little damage. The cupola of the public school building at Marshfield, which had a tin roof, was wrecked, but the building, which was roofed with shingles, was not injured to any extent.

Even more conclusive and remarkable, he thinks, were the phenomena manifested in connection with trees and shrubbery. The bark was stripped from the trees and bushes not alone on those sides exposed to the force of the cyclone, but on all sides. The ends of the branches were not only denuded of their leaves and bark, but were rifted into fine fibers, so that they presented the appearance of little brooms. The active agent in such cases, he insists, was not wind, but electricity. Under its influence the sap under the bark was instantly converted into vapor or gas, expanding two thousand times in volume, and, as by an explosion, threw off the bark, shattered the trunk, and split the green twigs into fibers. That this is what took place is, he says, conclusively proved "by the fact that the dead and dry limbs and twigs were not affected, and though in immediate contact with green ones, remained intact."

General evidence of the electrical character of all tornadoes is found by Prof. Tice in the circumstance that, as a rule, they follow railroads and water courses, and either begin or expend their greatest energy upon them.

This, however, may be only a matter of topography. Rivers and railways usually follow the easiest grades, and these would naturally be followed by wind rushes taking the same general direction. It is a noticeable fact, all the same, that the cyclone which destroyed Marshfield followed the St. Louis and San Francisco Railroad for a distance of 145 miles, and lapped up all the water in the ponds and rivers in its course from where it commenced in Arkansas to where it terminated in Missouri.

NEW ATLANTIC SEAPORT IN FRANCE.

BY GEORGE L. CATLIN, LATE U. S. COMMERCIAL AGENT, LA ROCHELLE.

Prominent among the great public works projected by the French government, with a view to the commercial regeneration of France, is the construction of a new seaport at La Rochelle, at an estimated cost of 15,000,000 francs.

Owing to the building of a dike across the present harbor of that city by Cardinal Richelieu, during the famous siege of 1628, the accumulation of two centuries and a half's deposits of mud and sediment have so choked up the port that, with the exception of a channel twenty or thirty feet wide, it is bare at low water, necessitating a system of locks and basins constructed and maintained at great expense.

La Rochelle has from her earliest days (she dates from the 12th century) been renowned as an enterprising maritime city, and for two centuries previous to the war of secession her commerce with the United States, especially in wines and brandies, was active and important. Even with the above mentioned and continually increasing disadvantages to contend with, she has continued to maintain extensive commercial relations with the principal ports of Western and Northern Europe. Two lines of steamers keep up regular and frequent communication with Bilbao and the Spanish iron mines in the Cantabrian Pyrenees; there are lines of steamers to Bordeaux, to Cardiff, to Newcastle, and large annual importations are also made from North Germany, Norway, and Newfoundland. With this spirit of commercial enterprise still struggling for recognition, it was not to be supposed that the Rochellais would remain inactive in face of the renewed impulse which the present spirit of French institutions imparts.

After long consultation and careful scientific inquiry, it has been determined that but one sure method exists for obviating the present evil and restoring La Rochelle to her former maritime prestige, namely, the creation of a new port of entry within easy distance of the city, yet entirely independent of the harbor which Richelieu so effectually blocked.

Fortunately, nature, seeming to have foreseen and provided for this need, offers remarkable facilities for the construction of such a port about three-quarters of a mile north of the entrance to the present harbor, and at a point where communication with the city and the railroad system converging to it is easy and simple. At the point in question, known as the *Mare* (pond) *à La Besse*, there exists a natural inlet or depression which, by comparatively little labor, may be dug to the requisite depth and walled in by quays. This inlet opens upon a deep roadstead, known as the Pallice, completely sheltered from the sea by the islands of Ré and Oleron, between which vessels must pass to enter it. When, on the one hand, one considers the facilities which this point, above all others on the French coast, offers for direct communication in a straight unbroken course with New York and the other American seaports, without any of the dangers incident to channel navigation; and, on the other hand, the fact that from La Rochelle direct lines of railway radiate to Paris, to the interior and east of France, to Bordeaux, and to all points along the coast, both north and south, it will be seen at a glance that this grand undertaking promises to prove prolific in results to the commercial world. The work will be begun in June, 1880.

LEGISLATING ON COLOR BLINDNESS.

The Legislature of the State of Connecticut has passed an act authorizing the State Board of Health to prepare rules and regulations for the examination and re-examination of railroad employes in respect to color blindness and visual power, and prescribes the method in which and the intervals at which such examinations shall be made. The act further makes provision for inflicting penalties on any railway company employing persons who are not in possession of a certificate from the examining board of their freedom from color blindness. The examiners may revoke the certificate at any time. The State Board is, in the month of May, to recommend two or more medical experts to make the necessary examinations, and the Governor is to appoint two of these gentlemen on the following first of July. It is to be hoped that other States will adopt similar measures for protecting the traveling public against the dangers incident to the visual defect of railroad employes.

NEW YORK ACADEMY OF SCIENCES.

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The paper on the theory of cloud bursts, by Mr. William Ferrel, of the United States Coast Survey, has an especial interest at this season of excessive meteorological disturbance in the West. Cloud bursts, Mr. Ferrel said, always occur in the interior of a tornado. The primary cause of a tornado is difference of density arising from difference of temperature between the internal central part and the surrounding parts of the atmosphere. This only occurs on an unstable state of the air, in which the temperature of the surrounding air decreases more rapidly with altitude than the interior ascending column. Since the interior ascending column diminishes with altitude less rapidly than the surrounding quiescent air, this interior part is much warmer, and, consequently, ascends very rapidly, and the air from surrounding parts flows in below to supply the ascending current, as in the case of a chimney when the interior once becomes warmer than the surrounding air without. In addition to this difference of temperature and density, the air must have an initial gyratory motion, almost imperceptible, it may be, at a short distance from the center, but as it is drawn in it runs into rapid gyrations near the center, just as in the case of water running through a small hole in the bottom of a basin of water. If the gyrations above and below had the same velocity, the violence of the gyrations and the pressure toward the center below would depend upon differences of temperature only between the interior and exterior parts. But on account of the great friction near the earth's surface, the gyrations are much retarded there, and, consequently, the centrifugal force which prevents the rush of the air, in some measure, toward the center. If the difference of barometric pressure between the central and external parts were 30 millimeters, and no centrifugal force below or friction to resist this pressure, according to the laws of spouting fluids the ascending current in the interior would be about 80 meters per second. If the gyrating velocity below were only one-half as much as above, the centrifugal force would be only one-quarter as much, and, supposing that this and friction were to resist one-half of the pressure below toward the center, we should still have residual pressure which would cause an ascending velocity of about 56 meters per second.

This theoretical velocity is obtained upon no extravagant assumptions, and that such velocities do exist in tornadoes is confirmed by observations of their mechanical effects. It will only be necessary to refer to one well authenticated case of this sort, given in the Signal Service report, at Mount Carmel, Ill., 1877. The ascending currents of a tornado carried a church steeple, gilded ball, and vane, 15 miles. This must have been kept suspended in the air by the ascending currents 20 or 30 minutes. If saturated air at a temperature of 30° at surface ascends with a velocity of 50 meters per second, rain to the amount of 1·2 millimeters per second falls from the first 2,000 meters of altitude—equivalent to 0·3 inch per minute, or 18 inches per hour. At such a rate, if the tornado could be kept over the same spot for a short time from any cause, it would be called a cloud burst.

At higher altitudes than 2,000 meters it may be supposed that the vapor and rain is scattered out from the center and falls over a larger area. But rain may not only fall from clouds at this enormous rate, but an immense amount may be kept suspended in the air. Drops of 0·1 inch may be kept suspended in the air by a current of about 23 feet per second. Of course, the amount of rain kept so suspended increases the pressure in the center, and so much diminishes the force and energy of the tornado. Our assumed velocity of 50 meters per second arises from a difference of pressure of less than 15 millimeters. Suppose, now, rain enough was contained in the cloud to reduce this difference to 5 millimeters. This would require rain to the depth of 136 millimeters, more than 5 inches. The difference of pressure of 5 millimeters yet remaining would give an ascending current of about 32 meters per second, which is four times more than is necessary to keep the rain suspended in the air. If, now, for any reason, the whole system should be suddenly broken up, as, for instance, when the tornado strikes against a mountain side, and the ascending current by which the 5 inches of rain is kept suspended is suddenly cut off, of course, the whole amount would drop to the earth in a short time.

Lieutenant-Commander A. A. Michelson described some novel and interesting observations on sunlight seen through a narrow slit. As the width of the slit is diminished the diffraction bands spread out and separate, until finally nothing is seen but the central bright space. At this stage the width of the slit is about one or two hundredths of a millimeter. It will be observed that the light has acquired a faint bluish tint. If a Nicol prism be placed between the slit and the eye, and the prism be rotated, it will also be found that the light shows traces of polarization. Further, when the light is faintest, the bluish tint is most decided. On still further diminishing the width of the slit, the bluish tint becomes more apparent, and on applying the Nicol prism the polarization is quite decided, the tint when the light is faintest being deep blue. When the width of the slit has been reduced to about 0·001 millimeter, the tint changes to violet, the polarization appears to be complete, and on turning the prism the tint becomes a more decided violet, until finally the light disappears. If the prism and the slit be interchanged, the same results follow in the same order as before. The material of which the edges of the slit are composed does not seem to affect the result. Slits made of iron, brass, and obsidian were employed. With the latter more perfect results were obtained than with the others, probably, however, because the edges were more perfect.

This experiment, Mr. Michelson said, may be varied, and the results shown in a very striking manner, by using a double image prism, when the two images may be compared side by side. The experiments are trying to the eyes on account of the faintness of the light. The conditions under which the phenomena may be best observed are: 1. The sun to be observed directly, holding the slit as close as possible to the eye. 2. A double prism is to be employed, so that the faint and the bright images may be observed side by side. 3. The width of the slit should be between the one hundredth and one thousandth of a millimeter. 4. The edges of the slit should be as nearly perfect as possible. The explanation has suggested itself that the polarization may be accounted for by considering that the greater part of the light which reaches the eye has been reflected from the edges of the slit.

The fact that the plane of polarization is at right angles to the length of the slit would seem to confirm this. The objections to this explanation are: First, that there should then be a difference in the behavior of different materials. Second, the polarization should be exhibited when the slit is wide as well as when it is narrow. These experiments seem to prove, first, that light in passing through a very narrow slit is partly or completely polarized in a plane at right angles to the slit; second, that such a slit allows the shorter waves of light to pass more freely than the longer ones.

It is proper here to express our indebtedness, in making these gleanings, to the ample reports of the papers read, published by the New York *Times*, the only one of our great dailies that paid any attention to the meeting of the Academy.

The Berlin Fish Show.

The International Fishery Exhibition, which opened in Berlin April 20, has proved a splendid success; and it is gratifying to read in the German and English reports that the exhibits sent out by the United States form in every respect the most remarkable collection in the Exhibition. The floating hatchery "Fish Hawk" attracts especial attention.

In his opening address, the German Minister of Agriculture, Dr. Lucius, said that the Fisheries Society, through whose efforts the holding of the Exhibition was due, had met with the most obliging support, not only in Germany itself, but in nearly all the neighboring countries, and even in the furthermost zones of the earth. From the Baltic and the German Ocean, the ice bound seas of the north, from the coasts of Holland and England, from the Switzer lakes, from the exhaustless riches of the Mediterranean, from the Volga and the Black Sea, from North and South America, from the coasts of the far East, from India, China, Japan, and the Malay Archipelago—the fauna of the waters had been brought in rare and wonderful profusion, with an endless variety of pearls, shells, and corals.

A Metallic Shower.

For several hours, on the night of March 29, a fall of rain mingled with meteoric dust occurred at Catania, Sicily. The dust contained fragments of iron, either in a pure metallic state or in metallic particles surrounded by an oxidized crust. The fragments were of many shapes and sizes, and were readily attracted by the magnet. They only differed in size from a shower of aerolites.

Such showers of meteoric dust are probably not infrequent, though it is seldom that they are so clearly indicated in southern lands. In high latitudes they are shown by frequent and well marked discolorations of the earth's snowy mantle in places where terrestrial dust is a practical impossibility.