manner vibrations whose curves shall be the same as those of any given tone or combination of tones, we shall receive the same impression as that tone or combination of tones would have produced on us.'"

"Reis discovered how to reproduce musical tones, but he did no more. He could sing through his telephone, but he could not talk. From the beginning to the end he has conceded this. In his first paper he said:

"'Hitherto it has not been possible to produce the tones of human speech with a distinctness sufficient for every one. The consonants are for the most part reproduced pretty distinctly, but the vowels as yet not in an equal degree. The cause of this I will attempt to explain.'

"And again:

"'I have succeeded in constructing an apparatus with which I am enabled to reproduce the tones of various instruments, and even to a certain extent the human voice.'

"None of the many writers whose papers are found in the records claim more than this for Reis or his discovery."

"We have not had our attention called to a single item of evidence which tends in any way to show that Reis, or any one who wrote about him, had in his mind anything else than that the intermittent current caused by the opening and closing of the circuit could be used to do what was wanted. No one seems to have thought that there could be any other way. All recognized the fact that the minor differences in the original vibrations had not been satisfactorily reproduced, but they attributed it to the imperfect mechanism of the apparatus used rather than to any fault in the principle on which the operation was made to depend.

"It was left for Bell to discover that the failure was due, not to workmanship, but to the principle which was adopted as the basis of what was to be done. He found that what he called the intermittent current, one caused by alternately opening and closing the circuit, could not be made. under any circumstances, to reproduce the delicate forms of the air vibrations caused by the human voice in articulate speech, but that the true way was to operate on an unbroken current, by increasing and diminishing its intensity. This he called a vibratory or undulatory current, not because the current was supposed to actually take that form, but because that language expressed with sufficient accuracy his idea of a current which was subjected to gradual changes of intensity, exactly analogous to the changes of density in the air occasioned by its vibrations. Such was his discovery, and it was new. Reis never thought of it, and he failed to transmit speech telegraphically. Bell did, and he succeeded. Under such circumstances, it is impossible to hold that what Reis did was an anticipation of the discoveries of Bell. To follow Reis is to fail, but to follow Bell is to succeed. The difference between the two is just the difference between failure and success. If Reis had kept on, he might have found out the way to succeed, but he stopped and failed. Bell took up the work and carried it on to a successful issue."

The other alleged anticipations of Bell's invention are then discussed, including those of Van der Weyde, McDonough, Varley, and Drawbaugh, all of which are dismissed as untenable. The decision is sustained by four of the judges, while three of them dissent, believing Drawbaugh to be the prior inventor.

At the conclusion of the reading of the opinion of the court, Mr. Justice Bradley said that: "Mr. Justice Field, Mr. Justice Harlan, and myself are not able to concur with the other members of the court in the result which has been reached. The point on which we dissent is the question of Drawbaugh's invention. We think that Drawbaugh did anticipate the invention of Mr. Bell. We think that the evidence to that point is so overwhelming, both with regard to the number and character of the witnesses, that it cannot be overcome. Of course, it is a question of fact depending upon the weight of the evidence, and involves no question of law, and therefore it is a matter that does not require much observation on the part of those who dissent from the opinion, which is very ably drawn, and undoubtedly presents the whole case with great force. But on this point we cannot concur in the views of the court. We think that Drawbaugh did have an instrument in his shop as early as 1869 which used the variable resistance instrumentality in transmitting articulate speech to a distance, by means of electricity, and was distinctly heard and understood. That is the whole invention, so far as variable resistance is concerned.

"We also think that as early as 1871 he did produce an instrument employing the magneto-electric instrumentality altogether, substantially the same as that which is claimed in Mr. Bell's patent. In the one case, with regard to the variable resistance principle, over seventy witnesses were produced. The evidence of some of them may have been shaken with regard to the time that they had in mind; but the evidence of the great majority of them is not shaken at all. They were mostly plain people of the country, but they heard the words, and that is a matter that they could not be mistaken about. It did not require science nor literature nor refinement to understand that.

"In regard to the other instrument, some forty or fifty witnesses were produced who saw it. Many of them heard the language produced through it, and a number of witnesses who did not hear the language produced through these instruments saw them or heard them talked about, so as to fix the time that they were in existence, and it seems to us that on this subject of time and of result there is such a cloud of witnesses that it is impossible not to give credence to them. There is no doubt that Mr. Bell's merits are very great in appreciating the importance of the discovery, and in bringing it before the public in such a manner as to make it appear to be what it is, one of the most important discoveries of the century. He was a man whose professional experience and whose scientific attainments enabled him to see at a glance the importance of it. Drawbaugh was a different sort of man. He did not see it. Had he done so, he would have taken measures to interest persons with him in it, and have brought it out. He was a mechanic, a plain mechanic, somewhat better instructed, perhaps, than most ordinary mechanics, a man of more reading, a man of more intelligence. But he looked upon what he made more as a curiosity than a matter of speculation, a matter of financial importance or of importance to the public. This is the way we view his condition of mind in regard to it, and explain why he had not taken more pains to bring it forward to the notice of the public. It is the tendency of the human mind to attach importance to the results and inventions of those who have achieved eminence. Watt was the idol of the British nation, from the time of his first invention of the steam engine until the day of his death, and until the present time; and everything that was invented about the steam engine was attributed to him. It was the glory of England, the glory of Watt, and of course every patriotic British subject would hoot at anything it was claimed Watt did not invent, or attribute it to him. That is a principle of the human mind on which we think a great deal may be explained with regard to the feeling toward this important service which Mr. Bell has rendered with regard to this invention. The plain mechanic of Pennsylvania is of no account. The scientific and illustrious—for he is illustrious—Mr. Bell, it cannot be but that he did invent this thing! And yet if Mr. Bell on the 14th day of January (I think it was) or February, when he applied for his patent at the Patent Office, had had in his laboratory the things that Drawbaugh had, he would have been filled with an excitement far exceeding that which has animated the great inventors of the world when they made the discoveries they have made, and he would have exclaimed: 'Eureka! Eureka!' He would have appreciated it, if Drawbaugh did not.

"What had he when he applied for his patent? On the 10th of June, 1875, they thought they heard something, but were not sure; but he knew the principle, and he patented it. Up to the time of making his application for a patent they had not succeeded in producing intelligible speech, more than a word or two; perhaps a word or two. If Bell had done at that time as much as Drawbaugh had done, according to the evidence, he would have had no hesitation in claiming the greatest discovery that the world has seen in the present century.

"This is an outline of the views which we have on this subject. We have nothing to say depreciatory of Mr. Bell at all, for he has real merits; but we think that this obscure mechanic did do the thing, and that he is entitled to the merit of being the first inventor.

"We will take an opportunity within a few days to write a further statement and file it."

CHIEF JUSTICE WAITE.

At six o'clock on the morning of March 23 occurred the death of Judge Morrison Remich Waite, the Chief Justice of the Supreme Court of the United States, and the seventh incumbent of that dignity. He was born in Lyme, Conn., November 29, 1816. In 1837 he graduated from Yale College and took up the study of law. He settled in Maumee City, Ohio, and there practiced his profession. In 1849 he was a member of the State legislature. A year later, he moved to Toledo. He was acquiring much influence in the political life of the day, and declined many offers of nominations to Congress, and refused also a seat on the bench of the State of Ohio Supreme Court. In 1871–72 he was one of the counsel for the United States before the Geneva Arbitration Tribunal. In 1873 he presided over the Constitutional Convention of his adopted State. On January 21, 1874, he received his appointment as Chief Justice of the United States, and has since devoted himself entirely to the duties of that position. He had written the decision in the telephone cases. Although far from well, he insisted upon attending the session of the court on March 19, when it was read. Judge Blatchford performed this duty, owing to the illness of the Chief Justice. As soon as possible after the reading, he drove home, and since then never rallied. Owing to his position, many adjournments of the courts throughout the country were taken.

Electricity in the Hotel Ponce de Leon, St. Augustine.

Mr. H. M. Flagler has, in his famous hotel, the largest isolated plant for supplying electricity in this country, or, in fact, in the world.

It consists of four Babcock & Wilcox multitubular boilers, each of which has a nominal rating of 107 horse power; four Armington & Sims engines, three of 60 horse power and one of 125.

Each of the 60 horse power engines drives an Edison dynamo of the latest type, having a capacity of 640 sixteen-candle lights. The other engine drives two machines of the No. 16 type. The rating given is nominal, as the plant admits of an increase in power of 25 per cent over and above the rating.

It is doubtful if there exists another electric light plant with so perfect a system of control and regulation.

Each dynamo has its own regulator, which controls the amount of electricity produced, and indicators showing the volume and pressure of the electricity.

The machines are all connected to heavy bars of flat copper, termed "omnibus wires," with which, by a switch in the headboard of the machines, they may instantly be connected or disconnected. To the "omnibus wires" are connected a series of heavy copper cables, called "feeders," which pass to the most important centers of lighting in the hotels Ponce de Leon and Alcazar. No lamps are directly connected to these "feeders," but they carry the current to the local distributing points, from which a large number of smaller wires, "mains," lead the electricity to the "services." These in turn conduct it directly to the lamps in the buildings.

Danger from fire by this system—the Edison—is reduced practically to *nil*. At the junction points of the "'bus wires," "feeders," and "mains," are inserted fuses, composed of an alloy of lead and tin, which volatilizes at a temperature of 400°. If, by any accident, the copper wires conducting the electric current should come in contact with each other, before the temperature of the copper could be raised sufficiently to set fire to any inflammable substance in proximity to it, the safety fuse would vaporize and open the circuit. As soon as the trouble had been rectified, a fresh fusible plug would be inserted, and the current reestablished in this circuit.

Nor is there any danger to human life from coming into contact with the wires or machinery of the system. The pressure is only of about 100 volts, which any child can receive with impunity.

This plant supplies all the lights used in the hotels Ponce de Leon and Alcazar—in all about 5,500 incandescent lamps.

Apropos of this subject, it will perhaps be of interest to mention an experiment which Mr. Flagler has been trying, in connection with the great artesian well which was, a few months ago, opened on the hotel grounds.

Directly over the well, which throws a solid column of water, 12 inches in diameter, 35 feet into the air, a huge turbine wheel has been placed. Bolted direct to the shaft of this wheel is an Edison dynamo, capable of supplying 375 sixteen-candle lamps. Several hundred Edison incandescent lamps have been placed on the walls of the building over the well, and together with the indicating and regulating apparatus connected with the dynamo. The trials in generating electricity by this way by power derived directly from the earth have proved eminently satisfactory, as far as the steadiness and constancy of the light are concerned; but the power secured has not been so great as was at first anticipated. This, in great measure, is due to the method in which the stand pipe is connected with the turbine, and to the arrangement of the paddles in the wheel, which allows a great deal of water to pass by. Changes are now being made which will obviate these troubles, and it is expected that when these are completed, the steam plant can be shut down late in the evening and not started again until early the following evening, the hydraulic plant furnishing all power necessary for supplying light in the interim.

Hydraulic experts throughout the country have condemned this scheme as impracticable, and have doubted the constancy of the flow of water from the artesian. This, however, has not in three months perceptibly diminished. The experiment is interesting, as being the first case on record where natural water power for driving machinery has been derived directly from the earth. It has been conducted under the supervision of Messrs. Wm. Kennish, an expert in hydraulics, and W. J. Hammer, of Boston, an electrical expert connected with the Edison Electric Light Co., and who is in charge of the entire department of lighting at the Ponce de Leon.

H. BRADFORD ROCKWOOD.

St. Augustine, Fla., March 13, 1888.

FORTY-THREE of Iowa's many schoolhouses are built of logs.