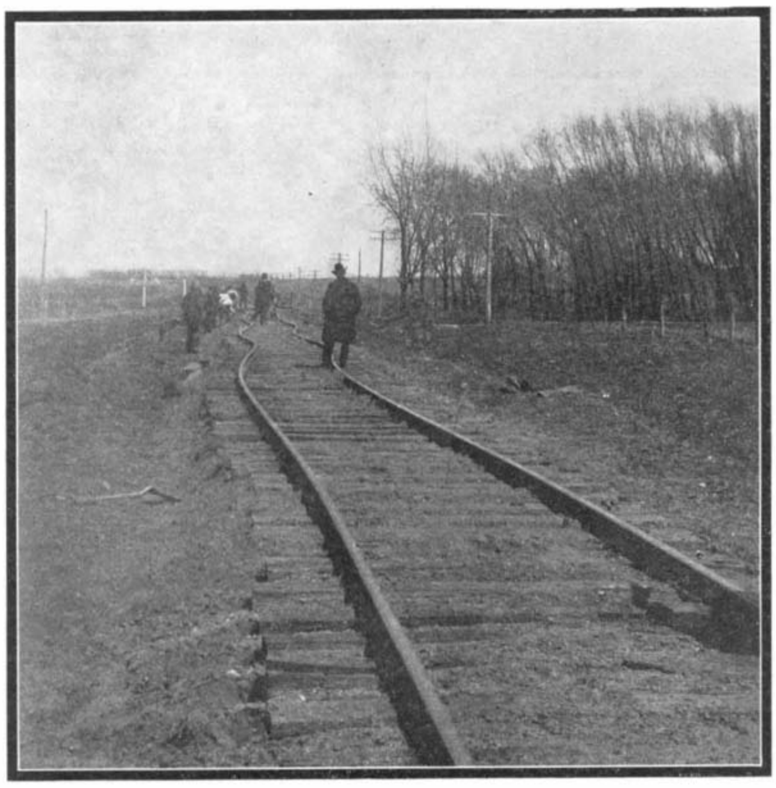
A BAD CASE OF WARPED RAILROAD TRACK.

The most extreme case of distortion of railroad track, due to changes of temperature, that ever came to our notice, is that which is shown in the accompanying illustration. It occurred on April 27, shortly after noon, at a point about three miles northeast of Waterloo, Iowa, on the Chicago & Great Western Railway, and it required no small amount of work on the part of the section gang to get the track back into such shape that the noon passenger train, which was stopped by the accident, was able to proceed.

The track, which was laid about two years ago, is at this point practically level, and the ties are laid in gravel and sand. Apparently there had been no very sudden change in temperature, the government readings giving 62 as the maximum temperature at Dubuque, Davenport, and Des Moines. The probable explanation is that there may have been a creeping of the track during the recent very cold weather, which caused a local closing up of the joints until the rail ends were in close contact; and that with the return of warm weather, the expansion of the rails caused the track to give way laterally at the spot where the resistance was least. It will probably be found that the resistance of the ballast to lateral displacement was considerably less on the stretch of track where the distortion took place, than for a considerable distance on either side of it. Railroad men are accustomed to distortions of the track due to temperature changes; but we think that the most experienced veteran will look upon this picture with no small amount of wonderment.



BAD CASE OF WARPED RAILROAD TRACK.

THE CYCLOGRAPH.

BY EMILE GUARINI.

The apparatus called a cyclograph, recently devised by Mr. Ferguson, is designed for the same purpose as the pedograph of the same inventor, that is to say, for automatically making a topographical record of the ground traversed during a journey. The new apparatus differs from its predecessor in that it is designed for the bicyclist, while the pedograph was designed for the pedestrian. It consists essentially of a flat box arranged horizontally upon the handle bar of the bicycle and containing a sheet of drawing paper, which, owing to the meridians that are traced upon it, may be kept constantly in position in the direction of the road according to the indications of a compass mounted upon the top of the box. As a result of the motion of the bicycle, the paper always moves backward in the direction of the longitudinal axis of the bicycle, and a small inked wheel rubbing over the paper inscribes a line upon it. If the bicyclist makes an angle upon the ground, he turns the paper (guiding himself by the indications of the compass) at an equal angle in the opposite direction. This is always done around a point situated beneath the marking wheel as a center. The paper immediately continues its motion backward as before. As a result there is marked upon the paper a line which exactly indicates the trip made. The motive power for actuating the cyclograph is obtained from a very simple eccentric arrangement fixed to the front wheel. A disk of thin steel, with an interior eccentric circle, is placed in the vicinity of the spokes of the wheel in such a way that it can revolve freely with the wheel without striking the fork. Upon the periphery of this disk slides a shoe forming part of a lever which is secured, in such a way that it can oscillate, to a small bracket projecting forward from the axis of the wheel outside of the fork. This arrangement may be seen in Fig. 1. When the apparatus is not in operation, the lever may be dropped out of contact with the disk. The apparatus may be easily started again by raising the lever until the shoe touches the edge of the disk.

Fig. 3 shows the manner in which the motive power thus produced is utilized in the apparatus. The horizontal lever, *A*, is capable of oscillating around the vertical shaft of the driving wheel, *B*, and striking alternately the posts, *C* and *D*. Of these latter, the first is stationary, and the second movable upon a graduated scale to which it may be secured by means of a thumb screw, *E*. In an inoperative position, the lever is held against *C* by the spring, *F*, which has sufficient strength to keep taut the wire, *W*, that runs to the eccentric. If a pull be given the wire, the lever will be moved until it strikes the post, *D*. The excess of power still exerted by the eccentric at this moment is absorbed by the spring, *G*. In this way, the lever is always limited to the amplitude of oscillation allowed by the adjustable post, and which ranges from zero to maximum, according to where the post is set. Upon each side of its fulcrum point the lever is provided with vertical flanges, *H*, which leave between them and the rim of the wheel, *B*, two oblique spaces in which the disks, *K*, are inserted in such a manner that they have a slight play. If the lever, *A*, moves toward *C*, the disks will slide with an imperceptible friction along the rim of *B*, in such a way that the rubbing spring, *L*, can only just maintain the wheel, *B*, in position. When the lever moves in the opposite direction, the small disks, *K*, become jammed between flanges, *H*, and the wheel, and thus turn it. The reason for this is that when the lever moves in one direction the disks, by rubbing against the wheel, are pushed into the widest space between the flange, *H*, and the wheel's periphery, while when the lever moves in the opposite direction they become jammed in the narrowing space between *H* and the wheel rim, thus moving the latter, as stated above. The result is that the various positions in which the post, *D*, is placed, will determine the amount of movement given the wheel at every revolution of the bicycle wheel, since each turn of this wheel produces an oscillation of the lever. The wheel, *B*, has a double-threaded worm, *M*, upon the upper end of its shaft, and this drives the small gear project above the cover plate, *O*, through a slot in the latter. The teeth of this gear, *N*. The teeth of this gear project above the cover plate, *O*, through a slot in the latter. The paper is placed upon the plate, *O*, between the gear, *N*, and the inking wheel, *P*.

If, as a consequence of the oscillations of the lever, *A*, the gear wheel, *N*, begins to move, it will carry the paper along with it. The inking wheel will revolve and draw a line upon the upper surface of the paper, while the teeth of the gear wheel will leave their marks upon the lower surface. These marks will be spaced one millimeter apart. As every oscillation of the lever corresponds to one revolution of the wheel of the bicycle, and consequently to about 2.15 meters (7 feet) of the road, one millimeter upon the paper therefore represents as many times 2.15 meters upon the road as it has required oscillations of the lever, *A*, to cause the wheel, *B*, and the worm, *M*, to make only a revolution. The latter is double-threaded and moves gear, *N*, one tooth for every half revolution that it makes. The scale may therefore be established at will for any value from one ten-millionth up to $1/x$.

In order to prevent displacement of the paper, the apparatus is completed by the arrangement *U T A′ V*, which serves at the same time to turn the paper at a certain angle. *U* is a rod provided with a grip, by means of which the arrangement is actuated; *T* is the prolongation of the rod; *A′* a milled wheel mounted upon a spring that plays the part of a flexible shaft; and *V* is another roller, which presses the paper against *A′* which projects through a slot in the plate *O*. If the route is north-south, the paper will be moved regularly backward; but if the road turns, the bicyclist turns the paper at the same angle by means of the arrangement just described and as indicated by his compass.

In order to do away with the inconveniences inherent in

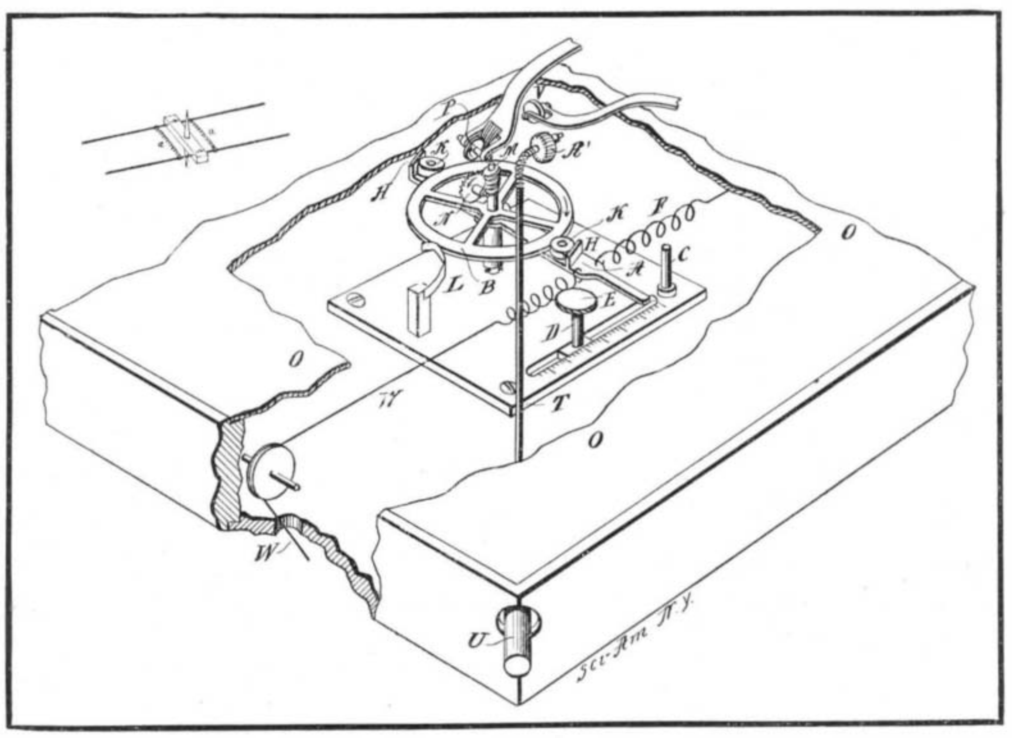


Fig. 3.—DETAILS OF THE MECHANISM OF THE CYCLOGRAPH.

Fig. 1.—THE CYCLOGRAPH ON A BICYCLE.

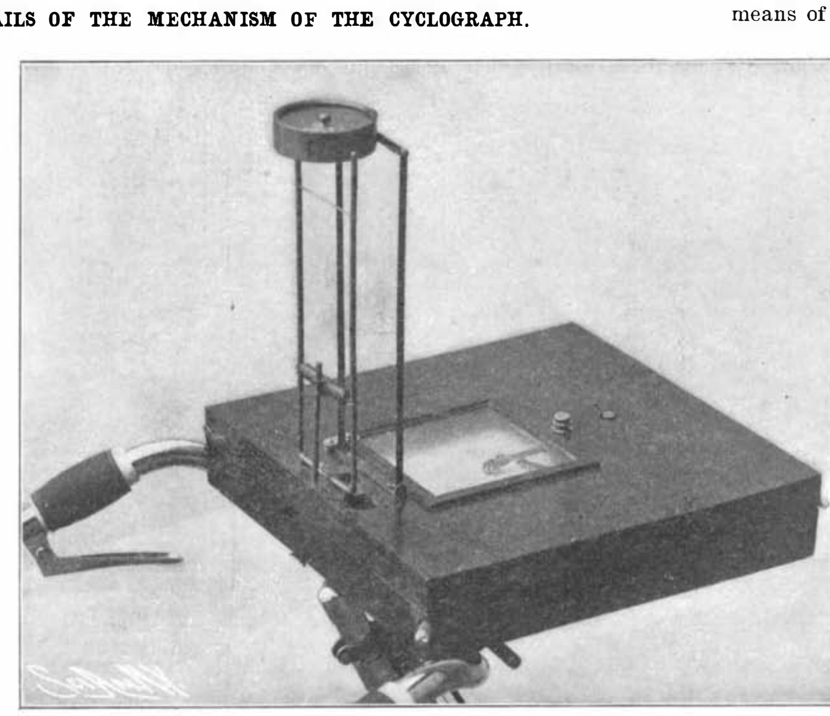


Fig. 2.—THE FERGUSON CYCLOGRAPH.

its use, the compass is constructed so as to assure its needle a magnetic moment as great as possible, and a moment of inertia as small as possible. For this purpose, the compass is arranged as shown in Fig. 4. Two steel needles are fixed to a small piece of wood through which passes the vertical axis. Two small springs, *a*, serve to regulate the equilibrium. The two points of the axis move in agate bearings. The bottom and cover of the compass are of glass so as to permit the rider to see through it the meridians previously inscribed upon the paper and to keep them parallel with the needle. This manipulation is effected by means of the arrangement *U T S R* (Fig. 3) already described. The compass is placed about 10 inches above the box in order to protect it against the magnetic effects of the rolling machine.

In order to avoid vibrations, the compass is mounted upon a rectangular frame of strong copper wire (Figs. 1 and 2) fixed by a hinge to the cover of the box, upon which it can be turned down. The compass is capable of revolving upon this frame, and it is held by two independent rods parallel with the surface of the box. The vibrations are thus subdivided and absorbed by eight movable and elastic parts.

In the experiments that were made with the apparatus, the results were such that it was scarcely possible to distinguish the lines thus obtained from those found upon an official map. So before the apparatus was put upon the market, a sample was ordered by the Intelligence Branch of the English government with a view to utilizing it in China, the topography of which country has been but slightly studied, although the country is provided with good roads. In all countries of this kind, the Ferguson cyclograph will certainly be of great value.

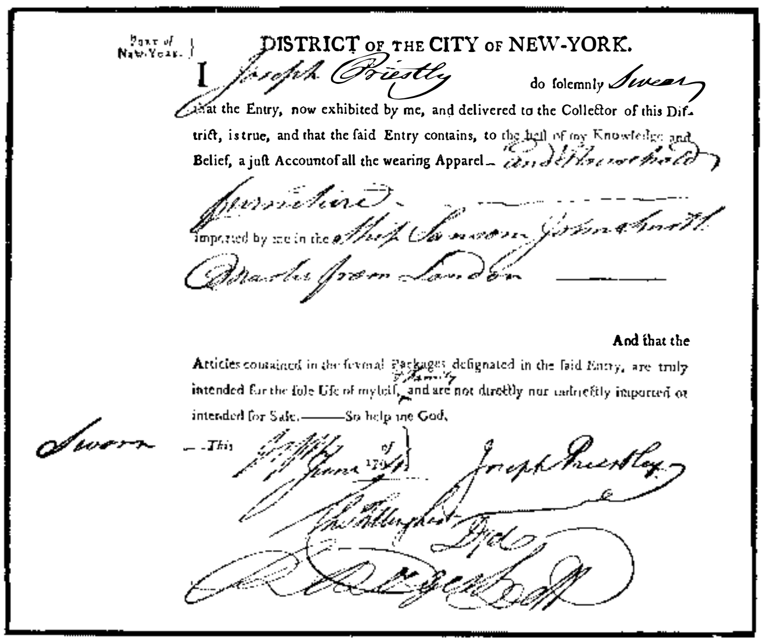
FACSIMILE OF DR. JOSEPH PRIESTLEY'S INVOICE ON COMING TO AMERICA IN 1794.

BY GEORGE F. KUNZ, PH.D.

These valuable documents were recovered from a mass of old papers, many tons in weight, containing thousands of signatures of men noted in local and national history, that was sold for waste paper in connection with the coming removal of the New York Custom House to its new site near the Battery. Their value was suspected, and the New York Scenic and Historic Preservation Society made many efforts to prevent their disposal in such a manner, but without avail.

Dr. Joseph Priestley, whose name is forever associated with the discovery of oxygen, was born near Leeds, England, in 1733. His great discovery was foreshadowed in a paper on the properties of the "different kinds of air," published in the Philosophical Transactions of the Royal Society in 1773. It received the Copley medal, as a communication of great importance, but its full significance was by no means understood. The next year, 1774, is usually given as the date of the actual discovery of oxygen gas, which he termed "vital air," or "dephlogisticated air," but never appreciated its real character. This was recognized and determined some fifteen years later by Lavoisier; but Priestley himself remained all his life a believer in the old theory of "phlogiston."

Dr. Priestley was a dissenting minister, but developed a growing tendency toward Socinian views in theology and liberal doctrines in politics. He was always much interested also in philosophical and scientific studies. After holding several positions, as pastor of churches, tutor in Warrington Academy, and scientific librarian to the Earl of Shelburne, he took charge of a church in Birmingham. When the great agitation connected with the French revolution came on, he was suspected of sympathizing with it, on account of the advanced liberalism of his general views. Public excitement ran very high on that subject; and in 1791, on the occasion of a celebration at Birmingham of the storming of the Bastile, although Dr. Priestley was away, his house was attacked and burned by a mob, and his library and apparatus destroyed. After three years spent at Hackney, largely in scientific pursuits, he decided to come to America, where he had sons living at Northumberland, Penn. He reached New York in June, 1794; and the writer has in his possession the original inventory, from which the illustrations were made, in Priestley's own handwriting, of the goods and furniture which he brought over with him, in the ship "Sansom," Capt. John Smith, as also his affidavit, signed by him and by William Tillinghast,


Port of New-York. DISTRICT OF THE CITY OF NEW-YORK.
I Joseph Priestly do solemnly Swear that the Entry, now exhibited by me, and delivered to the Collector of this District, is true, and that the said Entry contains, to the best of my Knowledge and Belief, a just Account of all the wearing Apparel and Household [illegible] imported by me in the Ship Sansom John Smith [illegible] Charles from London
And that the Articles contained in the several Packages designated in the said Entry, are truly intended for the sole Use of myself and Family, and are not directly nor indirectly imported or intended for Sale.——So help me God.
Sworn This 7th of June 1794 Joseph Priestley
W. Tillinghast Dy. Col.

JOSEPH PRIESTLEY'S CUSTOMS ENTRY, 1794.

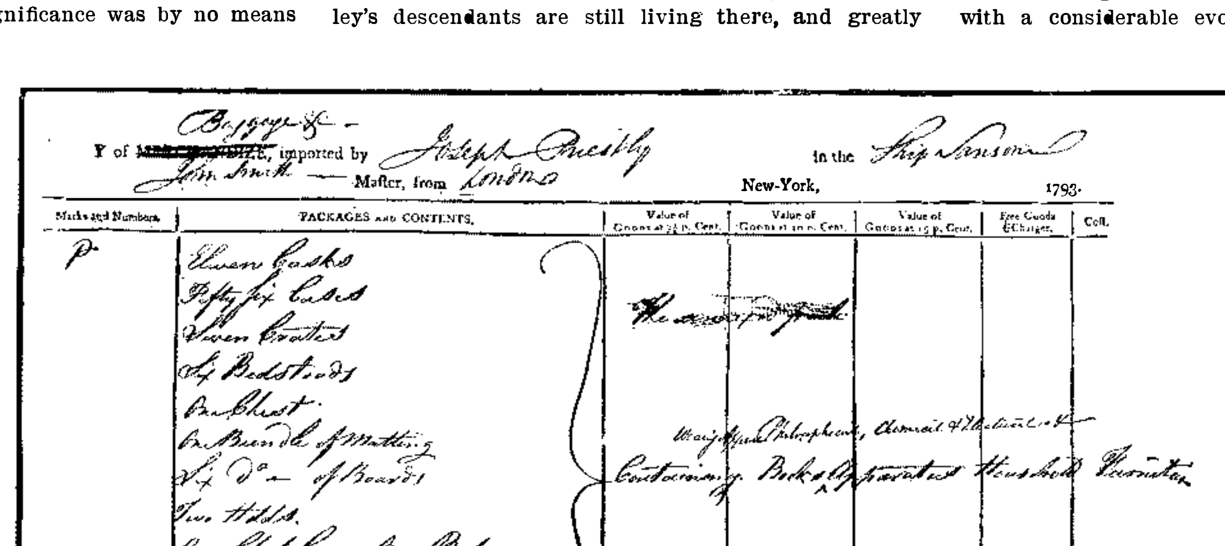
deputy collector of the port, declaring that "the articles contained in the several packages designated in this entry are truly intended for the sole use of myself and family, and are not directly or indirectly imported or intended for sale."

The list, it will be seen, is a pretty extensive one, comprising the furnishings of a large home as well as a laboratory. It is as follows: Eleven casks, fifty-six cases, seven crates, six bedsteads, one chest, one bundle of matting, six dozen of boards, two hogsheads, one clock case, one bale, one box, six trunks, one portmanteau, containing books, wearing apparel, philosophical, chemical, and electrical apparatus, household furniture, three boxes, two hampers, two beds and bedding. [Signed.] Joseph Priestley.

The remaining ten years of his life were passed at Northumberland, Penn., with his sons and family, and were occupied chiefly in his favorite scientific studies. He died in February, 1804, at the age of seventy-one.

In 1874 the chemists of America celebrated the hundredth anniversary of his discovery of oxygen, by a notable gathering at Northumberland, Penn., under the name of the Centennial of Chemistry. Dr. Priestley's descendants are still living there, and greatly revere his memory. Much of his old furniture and apparatus are preserved, the latter very interesting, not only historically, but as showing the simple, and, in many cases, home-made instruments with which a great student and observer did great and pioneer work in chemical research.

In the Kunz collection of scientific portraits and relics of eminent men of science, now in the Field Columbian Museum at Chicago, there is a letter from Dr. Priestley to a friend in England, in which he says that if he had known how cheaply and comfortably he could have lived in France, he would never have come to America. This letter was published, along with a number of others from and relating to Priestley, by Dr. H. Carrington Bolton in a volume a few years since.


Baggage — imported by Joseph Priestly in the Ship Sansom
John Smith Master, from London New-York, 1793.
Marks and Numbers | PACKAGES and CONTENTS | Value of Goods at 12½ p. Cent. | Value of Goods at 10 p. Cent. | Value of Goods at 15 p. Cent. | Free Goods & Charges | Coll.
P. Eleven Casks
Fifty six Cases
Seven Crates
Six Bedsteads
One Chest
One Bundle of Matting
Six D° of Boards
Two Hhds.
One Clock Case One Bale
One Box
Six trunks. One Portmanteau
Containing Books wearing apparel Philosophical, Chemical & Electrical Apparatus Household Furniture
Three Boxes Two Hampers Two Beds Bedding
Joseph Priestley

MANIFEST OF JOSEPH PRIESTLEY'S GOODS IN SHIP "SANSOM."

The Electric Organ of the Torpedo Fish.

In a paper recently read before the Berlin Academy of Sciences, J. Bernstein and A. Tschermak investigate the thermic phenomena shown by the electric organ of the torpedo or electric ray. Such physiological researches as have so far been made in this direction were intended merely to ascertain the intensity, direction, and duration of the electric shocks. It is safe to say that the electric discharges operative here have been found to consist of individual, short-lasting impulses, which always follow the same direction. The elements constituting the batteries of which the organ is made up, will assume a negative potential on the side where the nerve fiber enters the organ. As regards, however, the causes to which are due the potential differences produced in these elements, the investigations made up to this day were not able to afford any likely explication. Now, according to the recent thermo-dynamic theories of galvanic batteries, exothermic batteries (being heated during operation) should be distinguished from endothermic batteries, which, in the course of working, will undergo a cooling effect. Whereas, the E. M. F. of the former class of batteries is lowered with increasing temperatures, that of the latter class is found to increase. The authors made the following experiments for the most part in the Naples Zoological station. In order to determine the variations of temperature undergone by the electric organ of the fishes, they used Constantan batteries, consisting of ten to twenty elements, made up of plates or wires of iron and of this alloy (Constantan is an alloy of copper and of nickel containing 50 per cent of each), which were dipped in the dissected organ, or else introduced between the two organs of the same fish, while being in connection with an extremely sensitive Rubens galvanometer. The organ was stimulated from the nerve by means of currents from an induction coil, acting in most cases for one second. As it was impossible to evaluate the electric energy of the discharge by means of the electrodynamometer electric method, the authors determined the amount of heat evolved in the external circuit by means of an air thermometer analogous to the Riess thermometer. From these experiments, the remarkable result is inferred that the variations of temperature undergone by the stimulated organ are so small as to be inappreciable. The electric organ, accordingly, shows a thermic behavior essentially different from that of muscles. It cannot therefore be analogous to a battery working exothermically with a considerable evolution of chemical heat. It rather seems likely to constitute an endothermic battery, and, more especially, a concentration battery. With respect to the thermic behavior, it resembles a nervous tissue rather than a muscular tissue. These researches are further confirmed by experiments made with a view of finding the temperature coefficient of the power of the shocks.

Both of the two schemes for an electric high-speed railway between Berlin and Hamburg, lately presented to the Prussian railway department, provide for an electric central station to be installed in Wittenberg, the main station between Berlin and Hamburg. It is anticipated that the journey between the two cities, which at present requires upward of three hours with the fastest trains, will eventually be made in one and one-half hours only. As a matter of course, a new roadbed will be necessary, but the cost of this reconstruction does not seem to be prohibitory. The fact that a third track has been found necessary (which in the case of the electric high-speed railway being installed could evidently be dispensed with) is illustrative of the dense traffic existing between the two largest German cities.