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NEW YORK, SATURDAY, APRIL 18, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PROTECT THE THIRD RAIL.

The New York public is beginning to realize the risks of severe injury and even of death which attend the present arrangement of the third rail on the Brooklyn and New York Elevated Railways. Already there have been several accidents, some of them fatal; and although we have no doubt that in the majority of cases these accidents have been due to carelessness or disobedience of warnings and instructions, the fact remains that the third rail, as at present arranged on these railroads, is a source of very real danger. How great and far-reaching is this danger, was suggested only the other day, when a fuse blew out on one of the Ninth Avenue trains in Manhattan, and practically the whole train load of people got out and walked down the tracks to the nearest station. It may be said that they should have kept their seats; but in these days, when time is so valuable and business calls are pressing, it is a fact that the public, rather than sit still under these circumstances, will get out, take chances and walk. Now, had any of these passengers stepped on the third rail and one of the track rails simultaneously, or slipped and fallen across them, the result might have been fatal. As at present arranged, the third rail is unprotected from above, and short-circuiting by a careless person may easily happen.

Is it possible for the company to protect these rails without interfering with the operation of the trains? It certainly is; and the best proof of this is the fact that the third-rail, high-speed electric railroad recently opened between Wilkesbarre and Hazleton, Pa., has a hooded rail, which not only safeguards the public, but is free from the difficulties due to sleet and ice in the winter, which recently so greatly disorganized the elevated railroads in this city. The engineer who designed this system is the electrical expert for the elevated railways; and we have no doubt that this change could be carried out on the elevated systems if the public authoritatively demanded it.

THE LODGE-MUIRHEAD RECEIVER.

The prominence of Prof. Lodge in theoretical discussions of the Hertzian waves, lends special interest to the new Lodge-Muirhead system of wireless telegraphy, which we describe on another page. A vital part of all systems of wireless telegraphy is the coherer or its equivalent receiving device. The Lodge-Muirhead system provides a receiver which, while not differing in fundamental principles from certain previously known types of receivers, at the same time embodies a number of important features which should greatly increase its efficiency. The principle of using a thin film of oil as an insulating medium between the mercury electrode and that of the rotating disk brings to mind Branly's idea of contacts separated by a thin film of oxide. In the Lodge-Muirhead system, however, the idea of rotating one of these electrodes is a good one, for it permits better adjustment and at the same time serves to automatically re-establish the imperfect contact. The normal resistance of a coherer employing metal filings is not a reliable quantity. With the cohered particles being constantly jarred apart, the air gaps between them are liable to vary greatly in size, number, and position. Similar variations will be noted in receivers based on the principle of an insulating film, the thickness of the film at different points, though varying by an immeasurably small amount, being sufficient to appreciably affect the telephone of the relay circuit. By employing a revolving disk for one of the electrodes, a moving film of oil is carried on the disk and through the mercury. Though this film may vary in thickness to just as great an extent as between stationary electrodes, the resultant of all these variations will be an average resistance that is approximately constant. The high efficiency of the Lodge-Muirhead coherer is proved by the fact that a sufficiently powerful current may be used in the local circuit to operate a siphon recorder, thereby affording a visible record of the message.

FATAL GUN ACCIDENT IN THE NAVY.

The recent terrible gun accident on board the battleship "Iowa," in which three men were killed and several injured, is the second fatal gun disaster that has occurred in the navy within the past few months. It was only recently that there was an explosion of the charge of an 8-inch gun on the "Massachusetts," which caused the death of eight of the gun crew. In that case the charge exploded when the breech was open, and the disaster is not chargeable to any fault in the construction of the gun. In the present case it is evident that the 12-inch shell exploded just before it left the gun, and the terrific energy of the bursting of the 850-pound projectile completely smashed the chase of the gun outside the turret, driving some of the fragments down through the forecastle deck and killing and wounding the crew who were at mess on the gun deck below. So powerful was the explosion that three of the broken sections of the gun passed also through the main deck and gun deck, and only fetched up on the steel protective deck below. It is probable that the explosion was due to the fact that the fuse plug in the base of the shell, being a little too slack, allowed the flame of the explosion to pass through. This was found to be the cause of the premature explosion of shells on our battleships which took place two or three years ago. It is evident that some better method of inserting the fuse plug must be found, one that will be absolutely flame-proof when the gun is fired.

THE SO-CALLED DANGERS OF WIRELESS TELEGRAPHY.

The more or less popular mistrust and fear of wireless telegraphy is spreading, it seems, even to the technical papers. Our esteemed contemporary, the Electrical Review, recently published a sensational article on the dangers of wireless telegraphy, and further indorsed this article by favorable editorial comment. The absurdity of the whole matter is apparent when one stops to consider that the electric surgings set up in the receiving antenna by the Hertzian waves, though of very high voltage, are, on the other hand, of such an infinitesimal quantity that the most delicate of instruments is required to detect them. The writer of the article referred to, argues that "a great disturbance must be made at the center of an imaginary sphere in space, in order that even the small electromotive forces necessary for signaling may be developed in an electrically-tuned conductor, forming a tangent to the sphere, of infinitesimal length compared to the sphere's radius;" and that this disturbance must be so great that "the electric radiation of power to work a coherer across the 3,000 miles of the Atlantic would be sufficient to develop visible sparks across an air gap in a receiving system located within three miles, or one one-thousandth of the distance, even though they be not in tune with each other. Then he goes on to say that a telegraph or telephone circuit within this three-mile radius, particularly if the wires were run vertically to the top of a modern skyscraper, would similarly respond to these oscillations; and if the circuit contained a spark gap, such as that of an open-spaced lightning arrester, "a narrow break in some open translating device, or a loose joint in the wiring," we would have "an opportunity for a fire whose origin would certainly be of the mysterious class whose cause it is the fashion to assign to defective electric wires. At any rate, there would be a possibility of grounding the circuit and rendering it inoperative."

The whole discussion illustrates the recklessness with which some writers launch forth on an elaborate argument not based on facts or figures. The writer in question evidently overlooked the quantity of current set up at a transatlantic or even a local receiving station, overlooked the power generated at a Marconi receiving station, and above all overlooked the laws governing the radiation of Hertzian waves. According to his argument, Hertzian waves radiate in all directions, filling an imaginary sphere. Their energy would, therefore, vary inversely as the square of the distance, or, in other words, the energy at a distance of three miles would be one million times that at a distance of three thousand miles. As a matter of fact, Hertzian waves as set up by an oscillator travel out in a plane at right angles to the antenna, so that, roughly, their intensity is inversely proportional to the actual distance, and the efficiency at the three-mile station would be only one thousand times greater than that at the three-thousand-mile station. His deductions lead to the supposition that Mr. Marconi's "powerful thunder stations," as he calls them, must generate a quantity of electricity equivalent to that of lightning in order to cause visible sparking at a distance of three miles. Now, as a matter of fact, only 7 kilowatts were used in transmitting President Roosevelt's message to King Edward across the Atlantic. Furthermore, we are informed that Mr. Marconi's experiments are constantly leading toward a reduction rather than an increase of power. The writer of the article certainly overestimates the quantity of current generated in the receiving antenna, for, even within the three-mile limit, the quantity is immeasurably small. Even at the sending station the current must be reduced to an infinitely small fraction of an ampere in order to obtain the best results. In fact, we have held a piece of paper in a spark which was capable of affecting a coherer 50 miles distant. The paper was punctured, but not ignited, because, though the heat was very intense, the quantity generated in the spark was very small. What dangers of fire could ever arise from such cold sparks as these, to say nothing of the minute sparks set up in surrounding air gaps, which represent so small a fraction of the energy in the transmitting spark? As for the dangers of grounding a circuit by means of open-space lightning arresters, we can safely say that no spark of sufficient length to accomplish such a result can be generated within a short distance of the most powerful transmitter in use, even with the circuits perfectly in tune with the sending antenna.

WASTE OF CITY WATER SUPPLY.

The Commissioner of the Department of Water Supply, Gas, and Electricity, has given out some figures of the results obtained in his investigation of the question of the waste of water in this city. By dividing the city into districts, and by means of meters, supplemented by investigation, it has been possible to determine the amount of water served to each district daily, and also to determine what use is made of it. One method of calculating the waste is to examine the flow of water in the sewers during the early morning, when the consumption is lowest. A number of men are then sent through the buildings in the particular district under consideration, to measur the amount of water that is running to waste from leaky faucets, and similar fixtures. These measurements however, do not include water that is running to waste from overflowing tanks, nor does it take account of waste that occurs when the water is allowed to run on cold nights to prevent freezing; nor does it include underground leaks and leaks in the mains. As a result of this investigation, the conclusion is reached from the work already accomplished that 32,000,000 gallons, to 12 per cent of the Croton water, is running to waste every day from leaky fixtures, this percentage representing merely the waste in buildings from defective plumbing, which is a constant waste, and continues steadily throughout the dry weather, when the supply is scanty. It is estimated that this amount of water, if it were metered, would bring to the city $1,500,000 a year, and evidently it would be well worth while to recover the value of this water for its own sake, to say nothing of its value considered as forming a part of an already inadequate supply for the city, and the possibility that unless the source of supply be multiplied, we may have to face a water famine before many years have gone by. Commissioner Monroe is of the opinion that the most effective remedy for water waste is the extension of the meter system. His bill before the Legislature provides that all buildings shall be metered where steam is used for power purposes, and also all buildings that are over five stories in height. As the city will pay for the meters, the installation will not be hard upon the consumers, while the expense to the city will be light compared to the saving due to the prevention of water waste. Everyone who has the interests of the city at heart, and is disposed to look at this subeject from a broad-minded standpoint, will agree that it is of vital importance to the city of New York that water waste should be prevented, and everything possible done, whether by metering or some other method, to conserve its already inadequate supply.

ANNUAL REPORT OF THE UNITED STATES STEEL TRUST.

What is probably the most complete and circumstantial report ever issued by any great American corporation is the annual report of the United States Steel Trust, which has just been made public. The magnitude of the operations of this concern is shown by the following figures, which are taken from the report. The value of the properties owned and operated by the several companies that make up the trust is $1,325,000,000. Other assets, among which are included cash to the extent of $50,000,000, bring up the total assets to the sum of $1,547,000,000. It may be mentioned that the single item of $50,000,000 cash is equal to the amount voted by Congress at the outbreak of the Spanish war. The liabilities consist of $508,000,000 of common, and $510,000,000 of preferred capital stock. To this is to be added $361,000,000 of bonded and debenture debt, $50,000,000 of current liabilities, $25,000,000 sinking and reserve funds, and $78,000,000 undivided surplus of the United States Steel Corporation and subsidiary companies, which, with other items, brings up the total liabilities to $1,547,000,000.

The volume of business done by all the companies during the year, including sales between the companies and the gross receipts of transportation and miscellaneous properties, reached the total sum of $561,000,-

000. The manufacturing and operating expenses amounted to $411,000,000, leaving a balance of $149,000,000. Other expenses, interest charges, etc., brought the net earnings for the year to $133,000,000.

During the past year this corporation mined 16,000,000 tons of ore and 709,000 tons of coal, besides manufacturing 9,522,000 tons of coke. The iron produced by the blast furnaces aggregated 7,976,000 tons. The production of Bessemer ingots was 6,759,000 tons, and of open hearth ingots 2,985,000 tons. Under the head of rolled and other finished products for sale, we find that the corporation turned out 1,921,000 tons of steel rails, 1,255,000 tons of merchant steel, shapes, etc., and 1,123,000 tons of wire and products of wire. Other manufactures, such as blooms, plates, tubes, sheets etc., brought up the total output of finished products to 8,197,000 tons for the year. The present activity of the corporation is shown by the fact that the unfilled orders on the books at the close of 1902 amounted to 5,347,000 tons of manufactured products.

The average number of employes of the corporation during the entire year was 168,127, to whom the aggregate amount paid during the year in wages was $120,528,343. Of this total number of employes, 125,326 are employed in the various manufacturing properties. Finally, it is of interest to know that the total number of stockholders in the year 1902 was 58,629, which does not include the subscribers for preferred stock, nor 27,379 employes who availed themselves of an offer made them during last December.

THE ACCESSION OF GERMANY TO THE INTERNATIONAL CONVENTION.

The German Ambassador at Bern has notified the Swiss Federal Council that the German Empire will join the International Convention for the Protection of Industrial Property of March 20, 1883, as modified by the Act of the Conference at Brussels of December 14, 1900. The accession of the German Empire to the International Convention is to take effect on May 1, 1903.

The citizens of the United States and of the other signatories to the International Convention will therefore shortly be able to take advantage in Germany of the provisions of the treaty, the most important of which is that section which enables an inventor to file his German patent application during the year following the filing of his patent application in the United States, and to secure the United States date of filing as his date of priority in Germany, irrespective of the issue of the United States patent. As under the present law it is necessary to file a German patent application before the invention is disclosed in public print in any country, the amended provisions of the patent law will be availed of by many United States inventors, who, under the old practice, were debarred from protecting their inventions in Germany, because of the publication of their inventions, either on the issue of the United States patent or in connection with the introduction of the inventions.

THE REINTERMENT OF JAMES SMITHSON IN AMERICA.

Not so long ago the Italian government decided to remove all the bodies in the little cemetery of Genoa. That decision would not, in itself, very greatly affect the United States, were it not for the fact that in the cemetery in question the remains of James Smithson were interred in 1829. When the Smithsonian Institution was notified of the contemplated abolition of the cemetery, its Board of Regents decided to have the body removed to another cemetery in Genoa. Dr. Alexander Graham Bell asked the board to reconsider its action, and announced that he was ready to defray the expense of bringing the remains to this country. The proposition was favorably received.

It would be most fitting that the body of Smithson should find a last resting place in the country which he so greatly benefited. Foreigner though he was, Smithson gave his entire fortune of over $500,000 "to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." The gift is all the more remarkable, coming, as it did, from a man who had never seen this country and who was utterly unknown to us. It is pleasing to note that the faith which he had in the young republic has been justified in the benefits which the Institution that bears his name has conferred upon Americans. Perhaps more than any other public institution of the country, the Smithsonian Institution has stimulated scientific research among Americans.

A REGULAR TRANSATLANTIC MARCONI SERVICE.

At the time of his last visit to New York, Marconi informed a representative of the SCIENTIFIC AMERICAN that in the course of a few months a regular transatlantic wireless telegraphic service would be established. The promise then made has now been fulfilled. In its issue of March 30, the London Times headed its foreign news with two New York dispatches of about two hundred words each, which were received "by Marconigraph." A leader in the Times states that the message marked the establishment for the first time of the regular transmission of news by the Marconi system on a contract basis. After pointing out that messages can be sent from the United States to England at a cost but little in excess of the cable rate from England to France, the Times comments upon the slowness of Englishmen to appreciate at its true worth the meaning of Marconi's work. It says:

"They may rely upon it that considerable interests are going to be seriously affected by the new developments, and they would do well to cultivate whatever scientific and economic imagination they may possess.

"In the same way those who are responsible for national interests ought to very carefully watch and anticipate the bearing upon various strategical problems of the agency that more than ever before annihilates space and time."

The Times, it is said, will have for the present a monopoly of this system of carrying news, as the number of words that can be sent is rather limited.

NEW AMERICAN AUTOMOBILE SPEED RECORDS.

That the Ormond-Daytona beach is an ideal racing course, as one would expect from a glance at the illustrations of it in our recent Automobile and Yachting number, was proved by the breaking of several American speed records in the trials held there the last of March. A new kilometer record of 32 4-5 seconds was made by Winton in his "Bullet" racer. This was 2 seconds better than the time made by Fred Walsh on Fournier's Mors racer at the Staten Island speed trials last May. Winton also came within 2-5 of a second of equaling Fournier's mile on the Coney Island boulevard, by making this distance in 52 1-5 seconds. This is the fastest mile ever run by an American machine driven by an American. The present world's record figures for the mile and kilometer are 46 and 28 seconds respectively. Mr. Winton also reduced his 10-mile track record of 10 minutes, 50 seconds to 10:26 1-5. This included making a turn at the end of the 5-mile stretch. According to the stop watch of the gentleman who rode with him, Winton made the first 5 miles in 4:46 1-5.

The former American mile and kilometer records for cars under 1,000 pounds, made by L. C. Thompson on a Renault machine, were badly beaten by H. T. Thomas on a special 825-pound Oldsmobile racer. These records of 1:35¾ and 59 seconds were reduced to 1:06 1-5 and 42 seconds respectively. The motor bicycle records of C. H. Metz on an Orient of 1:10 2-5 and 43 3-5 seconds for the mile and kilometer were beaten by Oscar Hedstrom on an Indian motor bicycle, the new times being 1:03 1-5 and 39 seconds.

RUBBER VINE IN HONDURAS.

Recently Señor Don Floriano Davadi, governor of the Department of Conyagua, Honduras, informed the American consul at Tegucigalpa that some time previous he discovered in the Pijo Mountains a vine growing in an uncultivated state, varying in diameter from 4 inches to 2 feet, which on cutting produces a sap the nature of which is rubber. These vines grow to 100 feet in length, and they are said to belong to the African family of rubber vines. In Honduras, no one seems to know the name of the vine or the botanical family to which it belongs. The discoverer regards it as superior in quality to the Para rubber of commerce, and asserts that his convictions are borne out by the analyses made by American and European chemists.

The vine thrives at great altitudes as well as in the lower valley levels. Such luxuriance of growth has this plant attained that it is quite capable of being cut in commercial quantities. It may be quickly propagated in the rich soil of the Department by means of seedlings, and the growth being so much faster than that of rubber trees, Señor Davadi thinks the quantity of gum obtained would be large. The trees require six years' attention before sapping can begin.

It has been proposed to form a company for the exploitation of rubber in the Yoro district, but though the names of several prominent men have been connected with the enterprise, nothing has, as yet, been done to begin operations.

REPORT OF THE BERLIN-ZOSSEN TRIALS.

Chief Engineer Reichel has at last published his report giving the results of experiments made with high-speed electrical trains on the military road between Berlin and Zossen. At a speed of 100 miles an hour the electromotive force was 15,000 volts. Mechanical power equal to 2,500 horse power was used in starting the trains, which, when at full speed, required only 700 horse power. Mr. Reichel, in his report, gives it as his opinion that a speed of 125 miles can be attained, provided the required amount of electric energy can be supplied, as when at full speed from 1,400 to 1,500 horse power is required. For freight transportation also, electric power gave good results. A train of 200 tons gross weight was easily moved, even over grades of 1.2 per cent, at a speed of 32½ miles an hour. Through the possibility of supplying the motor car directly with a current of 10,000 and more volts, the weight of the motor cars and that of the transformers could be reduced from 92 to 78 tons.

SCIENCE NOTES.

Prof. Spring (Chem. Zeit.) has examined the commonly accepted theory advanced by Hagenbach, that the blue color of the sky is due to the refraction of light caused by solid or liquid particles floating in the air. In laboratory experiments the author never succeeded in obtaining the blue color, the reflected rays of light always showing either red, yellow or violet. Purification in no case removed the blue tint from the air. After exhausting all physical means in an attempt to reproduce the blue color, the author concluded that the blue of the sky depends upon chemical conditions. The color deepens instead of fades as the observer rises above the earth. These conclusions are supported by the fact that liquid air is also blue.

M. J. Thoulet has investigated the constitution of the ocean bed, and finds that the more deeply it is penetrated, the less the proportion of slime and the less calcareous matter. On the other hand, the proportion of sand grains and pure clays increases with the depth. No regularity obtains in the distribution of the non-calcareous mineral grains. This normal distribution appears to be more pronounced the deeper the ocean bed itself lies below the water surface, but, in any case, the variations due to ocean depth are small. Even in the deepest water the constitution of the bed shows traces of the conditions prevailing near the surface of the ocean above the bed. The latter remark is of importance, as the author points out, when we consider that a complete analysis—chemical, mechanical, and mineralogical—applied to ancient geological strata is competent to shed a flood of light upon the ancient conditions that prevailed at the surfaces of oceans that have long since disappeared, leaving no trace other than their effect on the ancient ocean beds.

C. Delezenne finds that the venom, both fresh and dried, of the cobra, the adder, and the puff adder, all contain a peculiar ferment, a kinase, which, although itself without proteolytical action on albumin, is able to impart to pancreatic juice a very powerful digestive action on that substance. This ferment is entirely destroyed by heating the venom to 100 deg. C. for fifteen minutes. The poison of the puff adder is the most active in this respect, 0.5 to 1 mgm. of the venom being sufficient to enable 1 c.c. of pancreatic juice to digest 50 cgm. of albumin in ten or twelve hours. Cobra poison was found to be slightly less active in this respect, while that of the viper had a marked lower proteolytic action, five or ten times more being requisite to produce the same effect. The kinase appears to resemble in its properties the ferments secreted by certain micro-organisms, and to possess the same action as the enterokinase of the intestinal juice. The part played by this substance in serpent venom is being investigated.

Metallic construction appears to have had a very low power of resistance during the volcanic eruption at St. Pierre. Not only was it incapable of withstanding the weight of the burning matter, says the American Architect, but some chemical action is likely to have taken place which transformed the particles. M. Amedée Knight, a senator of Martinique, was on the island at the time of the disaster, and he has been able to furnish details about the destruction which were not observed by others. He describes the effects shortly as corresponding with those which might be expected if some colossal Nasmyth's hammer had been employed in operation on the town. Most things have been reduced to a fine powder. One of the cases mentioned is the market of St. Pierre. After the cyclone of 1891 the authorities decided to reconstruct it in the most solid manner. Cast-iron was adopted. It is now impossible to find the slightest trace of a construction which had an area of 2,000 meters square.

A new and interesting departure in the shape of ships' hulls has been designed by Constructor Kretschmer, of the German Naval Department. He has been led to make this innovation in the desire to increase the efficiency of a vessel, without at the same time an abnormal augmentation of the coal consumption. Prof. Kretschmer, instead of designing the hull somewhat after the form of a fish, has taken as his model an aquatic bird, which, like the ship, makes its way along the surface of the water. In his design the ship's hull has the shape of a tetrahedron or double wedge. By this means it is anticipated that the efficiency of vessels will be increased by fifty per cent. Another great advantage is that such vessels will have no wash.