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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.

OUR VAST STEEL INDUSTRY.

The public has an idea that the United States Steel Corporation does business in a very big way; but the figures of its operations for a single year will probably be a matter of surprise, even to that part of the public which is more or less familiar with the magnitude of our steel industry. The figures recently presented by the president to the directors show that the trust paid out during its first year, in wages alone, the sum of $112,899,198. The cost of manufactured goods turned out by this vast aggregation of furnaces and mills was $343,000,000, and the selling price was approximately $459,000,000. These results show by simple subtraction the enormous profits of $116,000,000, from which has to be deducted, according to the customary Carnegie methods, the cost of maintenance, which is estimated for the whole plant concerned at a total of $24,541,689. The average number of employés during the year was 158,263, and their labor resulted in a total production of steel which is twice as great as that of Great Britain, and six times as great as that of France. In spite of these vast outputs and princely profits, the president stated that orders are booked for nearly twelve months ahead, and that the prospects for the coming year are even better than were those of the year just closed. That the past year has been a favorable one not merely to capital but to labor as well, is shown by the fact that the average wages paid by the steel combination is $712 per year, or approximately $2.25 per working day.

THE STATIONS OF THE RAPID TRANSIT SUBWAY.

The fear has been expressed that the local station platforms of the Rapid Transit Subway have not been planned on a sufficiently generous scale to accommodate the crowds that will flock to the new road as soon as it is opened, to say nothing of the increase in travel which will result from the steady growth of the city. We have no doubt that in planning the Subway, the Commissioners and their engineers gave careful consideration to this subject, and it is probable that in the case of the stations located in the more important centers, such as City Hall Park, Forty-second Street and the Circle at Fifty-ninth Street, ample provision for present and future needs has been made. The City Hall Park station, for instance, is one hundred and fifty feet wide by nearly four hundred feet long and contains four spacious platforms; a few hundred yards distant on the loop is another station where the platform will be two hundred and fifty feet in length, while the other more important stations on the Subway are of equally generous proportions. It is in the local stations that there would seem to be danger of crowding; for the standing room is of such restricted width that, should there be any blockade of the trains, the platforms, especially in the rush hours, would quickly become congested. With the discomfort occasioned by the narrow width of the Elevated stations in mind, the Rapid Transit Commission should see to it that platforms are made as commodious as the width of the streets will allow, even if they have to be carried beyond the building line. Rather than have to go to the great trouble and expense of making subsequent extensions, it would be better to build the local stations a little larger than is necessary to meet the immediate demands of the service at the opening of the line. If the road is to be pre-eminently a rapid-transit system, the quick access of passengers to the cars should be facilitated by every possible means, so that stops at stations may be as brief as possible. One of the surest ways to do this is to provide ample depth of platform for the incoming and outgoing streams of passengers as they approach and leave the cars.

ELECTRICITY OR STEAM FOR HIGH-SPEED RAILWAYS

In a report from our consul-general at Berlin on the recent high-speed electrical railway tests which were carried out between Berlin and Zossen, attention is drawn to the fact that although five months have passed since the rather sudden close of those experiments, absolutely no official report on the subject has yet been made. Furthermore, even the Studien Gesellschaft or specially organized company, under whose management and by whose support the experiments were conducted, has not prepared any official report for the information of its own members. Nor has it yet been decided when, if at all, the trials shall be resumed. The nearest approach to an official verdict was a paper recently read before an association of railway experts by the engineer who represented the government at the trials, which were carried out on a stretch of military railway line.

The line, 17.4 miles in length, was laid with 69-pound rails upon metal ties. The track, which had been in use for a number of years, was prior to the experiment put into perfect repair. At ordinary speeds it seems that everything worked to perfection, both on cars and track; but as a speed of 81 miles an hour was approached and exceeded, new and serious conditions were encountered. Both the rails and the ties proved to be too light for the strains. The track began to give way, and the side sway of the cars increased to a serious degree. The highest speed claimed was 99.4 miles per hour. As the announced purpose of the trials had been to make test speeds of from 125 to 150 miles an hour, the results have naturally caused a chill of disappointment among electricians in Germany; not, indeed, because of any failure of the electrical system as such, for the trials have proved that a polyphase alternating current carried on triple overhead wires and taken off by trolleys, could be led, at the high potential of 10,000 volts, into the flying car, and there transformed to a lower working pressure at which it was used in the motors. There is no question, indeed there never was any question in the minds of electrical experts, that the current could be got into the car for any speed that might be desired.

The disillusionment and acute disappointment is due to the fact that the failure of the specially prepared track proves that the greater proportion of the German railways cannot be adapted to high-speed electrical traction without being practically rebuilt. Although some of the leading lines have been relaid with 95-pound rails, many of the principal and all of the secondary railways are laid with rails of the old standard which failed so completely when the motor car exceeded the speeds which have been approximated on steam railroads. As Consul-General Mason pertinently remarks: "The Prussian state railways are conservatively and economically managed; they yield a large and steady revenue which the royal treasury needs from year to year, and it is clearly seen that any scheme of rapid long-distance transit which would require the state lines to be torn up, their curves straightened and their tracks relaid with heavier rails, will have long to wait." It is suggested that it is, as a more or less direct corollary to all this, that the German Society of Mechanical Engineers has once more taken up the high speed problem, and at a recent meeting voted a series of prizes for the first, second and third best designs for a steam locomotive and train which would be designed to form a unit in a scheme of rapid, long-distance passenger service. The engine must be capable of hauling a 180-ton train over a level track at a speed of 75 miles an hour for three hours without stopping. The cars are to be so designed as to form trains of three or four cars, each capable of carrying a hundred passengers and their baggage, with full provisions for food, drink and every necessary comfort during a journey of five to ten hours.

With regard to the high-speed railroad trials, while we sympathize with the German public in their disappointment over the poor prospects of any extensive institution of high-speed electrical travel, we must confess that to our thinking the results are satisfactory, not only to the electrician, but to the American railroad engineer. It has long been recognized in this country that a 75-pound rail is too light for modern high-speed railroad travel. Consequently our best roads are equipped with from 90 to 100-pound steel, while on one road at least, the track is laid on broken stone ballast which on many stretches of the line is as much as 2 feet in depth. We venture to say that had the German electrical engineers been able to carry out their trials upon a stretch of the New Haven, New York Central or Pennsylvania Railroad track, there would have been no necessity for them to stop the trials at a speed of something less than 100 miles an hour, on the ground that the track was giving away and the oscillation of the cars had reached the danger point.

And yet it must be admitted that even for American engineers, the Berlin-Zossen trials have drawn attention to what will prove always to be the weakest point in high-speed electric railways. For we must realize at the very outset that the strains on the roadbed will be far greater on electric than on steam railroads, not merely because of the higher speed, but because of the much more severe impact of the concentrated wheel loads on the track, and especially upon the track joints. In steam railroads the heavy loads concentrated on the axles are all spring-supported, whereas in the electric trains a large portion of the weight of the motors is non-spring-supported, and, therefore, its dynamic pounding effect in searching out weak joints in the track and soft spots in the roadbed is enormously intensified. Take, for instance, the electric cars of the magnificent four-track railroad which is to be built from New York city to Port Chester in connection with the New York subway. Here the non-spring-supported part of the motors will weigh between 8 and 9 tons, and at the high speeds of between 70 and 80 miles an hour, which will necessarily be reached at times to maintain the high speed schedule of the road, the smashing effect of this load will be something for which there is absolutely no parallel in any previous steam railroad service in this or any other country. The engineers of this new road, by the way, being fully alive to the new conditions imposed, are building the track with a solidity and strength surpassing even that of the best existing steam roads. Therefore, those of us who look for an early dawn of the era of high-speed electric railroads should feel no discouragement whatever at the failure of the German trials, or rather at the failure of the German track.

ROENTGEN RAY BURNS.

In a very complete article recently published in the Philadelphia Medical Review, Dr. E. A. Codman discusses the burns caused by exposure to Roentgen rays. Nearly two hundred cases are cited, and this large number should silence any doubts as to the reality of the danger. The cause of the Roentgen ray burns is not known, but the primary injury is sustained by the nerves controlling the nutrition of the skin, and there is no reliable evidence to show that injury has ever occurred in deeper tissues without primary interference with the skin. The appearance of the burn is similar to that of sunburn, giving rise in more severe cases to blistering and ulceration. It differs, however, from sunburn in the fact that the body is transparent to Roentgen rays, with a consequent result that the injury extends to the deeper layers of the skin and subcutaneous tissues, even involving tendon-sheaths and joints. A very curious feature of these burns is the fact that while in some instances the injury appeared immediately, in most cases a period of ten days elapsed before the burn was noticed, and in a few cases the burn was not developed until after a delay of months. Some people seem pre-disposed to the malady, while others are not affected in any way by exposure to the rays, and there seems to be no way of predetermining who will be susceptible to these burns.

The injury can be avoided in two ways. A thin grounded sheet of aluminium may be interposed between the patient and the source of the rays. Dr. Codman, however, favors the second method, namely, limiting the time of exposure to a period of safety. This latter preventive is given as a reason for the decreasing number of Roentgen ray burns during the last year, for much shorter exposures are now necessary for the radiographs. The doctor has tabulated a large number of cases in which the time of exposure and distance from the tube are carefully recorded, and comes to the conclusion that an exposure of 5 minutes at a distance of 10 inches from the anti-cathode would be a safe formula. From this we can easily determine the safety period of any distance, remembering, of course, that the power of the rays diminishes as the square of the distance from the anti-cathode. For example, a safe exposure at 20 inches would be 20 minutes, and an exposure of 45 minutes could be made on a subject 30 inches from the ray source.

Another curious phenomenon in connection with these rays is the fact that a repetition of the exposure on the same surface results in accumulative injury. A number of safe exposures oft repeated are seemingly as dangerous as a single long exposure. This would suggest the precaution that, where it is necessary to employ the rays up to the danger limit, an impenetrable metallic plate should shield the entire body, except that portion which is to be radiographed.

GUARDING AGAINST THE SUBMARINE.

For some time past the experimental staff of the British Naval Torpedo School at Portsmouth have been endeavoring to devise some means to frustrate the attack of a submarine upon a battleship. We published in the SCIENTIFIC AMERICAN a few weeks ago a description of a contrivance for this purpose, consisting of an outrigger torpedo fired from a pole projecting from the side of a torpedo boat destroyer. A torpedo fired in this manner resulted in sufficient shock to disable a submarine boat within a radius of 30 feet. The drawbacks to the scheme, however, were that the pole was shivered into fragments, at every discharge of the torpedo, while the torpedo boat destroyer itself also sustained a severe shock. Although various other contrivances have been tried, the outrigger torpedo and pole have proved to be the most feasible means for fighting the submarine. The experimental staff has now devised a new and stronger pole, which withstands the shock of the torpedo when detonated, but at the same time allows it to be fired with full effect. A series of trials with the apparatus has been carried out at Portsmouth in connection with a torpedo destroyer, and no ill effects were experienced upon the vessel during the discharge of the torpedo. So satisfied is the Admiralty with the apparatus, that it is to be generally adopted in the British navy.

THE UNITED STATES AND THE METRIC SYSTEM.

Despite the many efforts periodically made to abandon a system long since discarded by every civilized country with the exception of Great Britain, we still cling with Anglo-Saxon stubbornness to the yard, although it hampers us in our trade and complicates our methods of computation.

The most recent agitation in favor of a more rational system takes the form of a bill now before Congress, the purpose of which is to authorize the adoption of the meter by the different departments of the United States government. Most scientists are in favor of the bill. Indignant protests, however, have not been wanting. The American Society of Mechanical Engineers, for example, believe that the metric system "will inconvenience and hinder trade and manufacturing, and require an expenditure of time and money that cannot be expressed in figures, sweeping away as it does the advantages accruing from the numerous established standards now recognized and universally adopted throughout the country."

Keeping that very strong condemnation in mind, it is rather interesting to learn what manufacturers themselves think of the metric system. The Director of the new National Bureau of Standards recently sent out some thirty letters to the leading machine-tool makers in the country, asking for an expression of opinion. The replies received, so far from indicating any opposition, show an overwhelming confidence in the mechanical possibilities of the metric system. Indeed, many of the manufacturers were making machine-tools to metric dimensions.

The American Society of Mechanical Engineers opposes the adoption of the metric system on the ground that the standard inch is better adapted to the calculations of the machine-shop than the millimeter. It is true that by continual bisection of the inch wonderfully accurate measurements are made. And yet the constant tendency in machine-shop practice to use the tenth, hundredth and other decimal parts of an inch, would seem to show a desire to adopt a more scientific system of measurement.

In a half-hearted way the metric system is even now partially used by the government. Foreign mail matter is weighed by grammes, and yet, most reference books and postal guides give the equivalent, for the most part inaccurately, in ounces. The Revised Statutes of the United States, section 3,515, read:

"The weight of the piece of five cents shall be seventy-seven and sixteen-hundredths grains troy." Why this needless circumlocution for five grammes? Surely the business interests of the country can not profit by so complex an expression of weight.

The present movement in favor of the metric system is partially due to the use of metric units in electrical engineering, the standards of which were fixed upon a metric basis by the law of July 12, 1894. The unit of power is the watt, which is equal to 10,000,000 units of power of the centimeter-gramme-second system, and which is practically equivalent to work done at the rate of 1 joule per second. By reason of the enormously rapid development of the applications of electricity, most of us are familiar with the more important electrical units. Especially is this the case with the kilowatt, which is fast taking the place of the old "horse power."

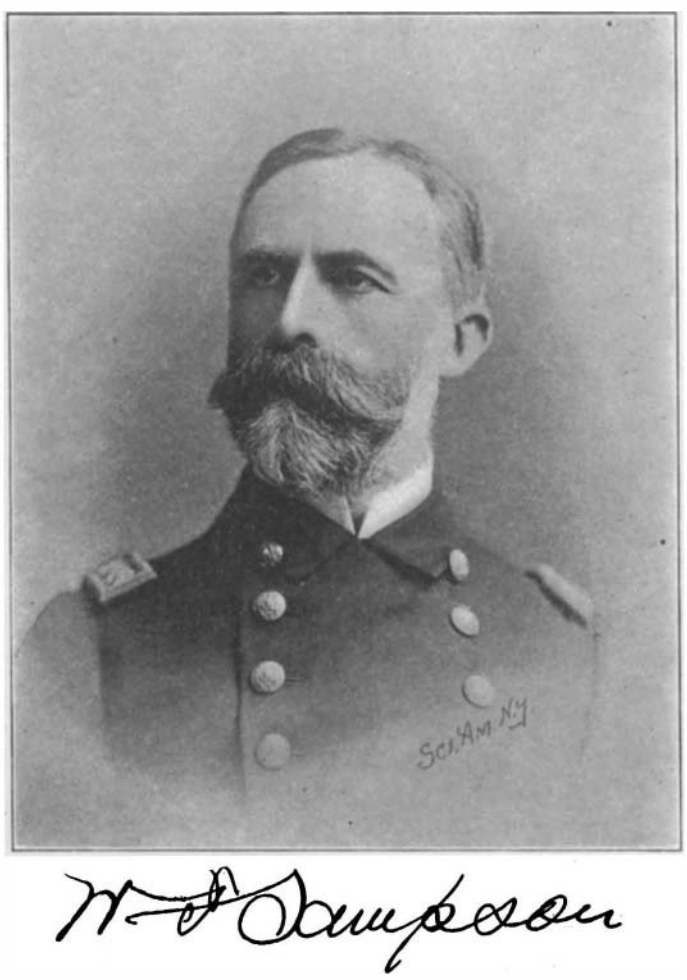
For years the United States Mint has employed the metric system in matters of assay and coinage. Our small silver money weighs 1 gramme per 4 cents. We use the metric weight in everyday life without our knowing it. Who hears of the troy pound nowadays in coinage?

Pharmacists, who of all men should cling tenaciously to the troy system, have long been accustomed to the employment of metrical units. The United States Pharmacopœia, the book most often referred to by the apothecary, is based upon the metric system; so is the Dispensatory, used by physicians. Fine chemicals are now sold chiefly by metric weight; so are glassware and rubber stoppers. Even catalogues in which the prices of goods are given in metric terms are not infrequently met with.

The United States Coast and Geodetic Survey is another department of the government which has long since adopted the metric system. Superintendent of Standard Weights and Measures T. C. Mendenhall, who is one of our foremost authorities on the subject of weighing and measuring, has, with the approval of the Secretary of the Treasury, established the metric system in the Office of Weights and Measures.

In the field of manufactures, the prospect of an early adoption of the metric system is encouraging. In the April, 1900, report of the American Railway Associations Committee, manufacturers were enumerated by whom the metric system is used. The list of products made by metric measurement included watches, injectors, refrigerating apparatus, screw-cutting lathes, scales, drills, gages, measuring implements of all kinds, and draftsmen's tools.

From the standpoint of dollars and cents—the standpoint of the American exporter, who is just now very much the object of public attention—the metric system should certainly commend itself. With the exception of England, every country with which he deals uses the system. No foreign merchant who is accustomed to purchase by kilogrammes and meters, is likely to trouble himself with our complex English units. How well this fact has been recognized is shown by a consideration of some of the products which we export. Ordnance, including both heavy and light, which we have sent to foreign countries, is calibered in millimeters.



The Baldwins build locomotives which are made to travel on one meter gages. Indeed, there is not a first-class shop in the country that is not ready to fill orders for machinery made according to metric measurements. With the increase of our exports, a still wider application of the system may be expected.

When it is considered that the metric system is an international system, that it is simpler than any other (for it is much easier to convert centimeters into meters than it is to convert inches into feet or yards), and that the young men who have graduated from our technical colleges are familiar with its units, there seems to be no very good reason why the change advocated by the measure now before Congress should not become a law. Nothing in this measure prevents any one from using the old system if he so desires. Land can still be sold by the acre in the country and by the square foot in New York city. But one thing at least is certain—if the United States government adopts the system officially, and uses it in its commercial relations with private persons and foreign nations, it will sooner or later be adopted throughout the country.

An item recently appeared in the New York Sun that gives the bibulous man something to think about. It is said that H. Charles Obendaugh, of Binghamton, N. Y., has perfected a process of distillation and compression whereby whiskey can be compressed and carried like pills. . Before the possibilites of the whiskey pellet the imagination must stand aghast.

ADMIRAL SAMPSON.

In the death of Admiral William T. Sampson the country has lost one of its most distinguished men, of whom history, we believe, will speak in even yet more positive terms of approbation than do we, whose painful duty it is to record his death and give the customary brief obituary to his honorable, patriotic and most useful life. Nowhere will the worth of the late Admiral be more freely acknowledged than among his brother officers in the United States Navy. It was a fortunate circumstance for himself and for the Navy that the period of its reconstruction found him in the prime of his physical and intellectual powers, for to no one more than to Admiral Sampson is our new Navy more indebted for the universally admitted excellence of its ships and material. His reputation could very well have rested, at least as far as the history of our modern Navy is concerned, with the good work that he did as Chief of the Bureau of Ordnance of the Navy in the construction of the new type of high-power built-up breech-loading rifles and such radical improvements as face-hardened armor plate; for Sampson was an ardent supporter of the Harvey theory, and the early application of Harveyized armor, be it known, placed the United States ships for many years far in advance in defensive qualities of all the vessels of the navies of the world.

When the exigencies of the war with Spain demanded the selection for the command of our Navy of a man with special qualifications, Sampson, although not the senior ranking officer, was chosen, the selection being made because of the technical knowledge, executive ability, calm, judicial sense, and unquestioned courage which he had abundantly displayed in his earlier career. The manner in which Admiral Sampson conducted the naval operations in West Indian waters amply justified the nation's choice, and the technical and military features of the campaign, as ordered by him, have received the practically universal indorsement of naval experts throughout the world. It is true that, for a while, his record was obscured by those miserable miasmas which arise from the swamps of political intrigue and personal hostility; and it is to be feared that the positive cruelties to which he was subjected by his political enemies may have helped to bring about his premature death. Whether that is so or not, it is certain that already the miserable Santiago controversy is being forgotten, and that the heart of the American people is more than ever with the man who, through all the bitterness of that strife, never once opened his lips to make any reference, tacit or otherwise, to the subject.

William T. Sampson was born at Palmyra, N. Y., February 8, 1840. He was born (to his greater honor, be it said) of humble parentage. Whatever of greatness he achieved was won by dint of the sheer force of sterling character. As a lad he divided his time between labors on his father's farm and the Union school, and from the very first he began to draw out ahead of his fellow scholars. He entered the Naval Academy in 1857; three years later he graduated at the top of his class. He had his first taste of the sea in the frigate "Potomac" in 1861; in 1862 he was a lieutenant. Two years later he was detailed to the ironclad "Patapsco," and in the following year, while he was executive officer of that vessel, he was ordered to enter Charleston Harbor and remove or destroy the submarine mines and torpedoes by which the city was protected. In carrying out her work the "Patapsco" was blown up by a submarine mine, and Lieutenant Sampson was thrown clear of the vessel by the force of the explosion, being subsequently rescued from the water with twenty-five of his men. He was attached to the Naval Academy from 1868 to 1871, and in 1874 was made a Commander. From 1879 to 1882 he commanded the "Swatara" on the Asiatic station. Then followed two years at the Naval Observatory, during which time he was a member of the International Prime Meridian Time Conference. He had charge of the torpedo station from 1885 to 1886, and at the same time he was a member of the Board on Fortifications. The period from 1886 to 1890 was spent at the Naval Academy. In 1889 he was promoted to the rank of Captain, and in 1892 was made Inspector of Ordnance, and in 1893 Chief of the Bureau of Ordnance. At the outbreak of the Spanish war Captain Sampson was made Acting Rear-Admiral by the late President McKinley and placed in supreme command, hoisting his flag on the cruiser "New York." He was held to be a great authority on torpedo work, and his lectures at the War College have a world-wide reputation. It was due to his influence that the double-deck turret was introduced on the battleships "Kearsarge" and "Kentucky," and as Chief of the Bureau of Ordnance he was largely instrumental in the construction and equipment of the very fine gun factory at the Washington Navy Yard. His death has left a gap in the ranks of our abler naval men that will not be easily filled.