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NEW YORK, SATURDAY, MAY 17, 1902.

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 re-