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## PAUCITY OF MONUMENTS TO ENGINEERS.

The commemorative honors recently paid to the memory of John A. Roebling, whose name will be forever famous for the daring and skill with which he flung his beautiful suspension bridge across the East River, New York, suggest the thought that, if the winning of posthumous public memorials is reserved for those who have done not merely good service, but the most distinguished, widespread, and lasting service for their country, there should be many such memorials erected to commemorate the great engineers of the United States. We think it may be asserted without fear of contradiction that the engineer has had more to do with the phenomenal physical development of the United States than any other professional man. We mention the civil rather than the mechanical engineer first, for the reason that, in the development of a new country, it is he that blazes the way. Far in advance of the oncoming tide of civilization, he may have been found at any time during the past seventy-five years which cover the history of the railroad development of this country (to instance his greatest field of activity), solving with his transit and level and steel tape the problem of opening a highway through the prairies, mountains, and trackless forests of the middle and farther West. More often than not, he was a quiet, thoughtful man, making up in resourceful energy what he might lack in volubility and the arts of display. But where he has passed, he has left an imperishable record. As James J. Hill recently remarked, "The civil engineer is pre-eminently a man that does things"; and truly, he has done things with the hand of a Titan, as witness the 230,000 miles of railroad, freighted with a nation's wealth, with which he has covered the country. In his adaptation of means to ends, where the means were often all too scanty, he has shown the true hand of genius; for had he not broken away from the conservative methods of older and richer countries, the problem of the prairies and mountains of the West would be to-day unsolved, and we would still be speaking of the "Great American Desert."

Where, at the present writing, can we find any monument to these engineers who have made possible a railroad system which is one of the marvels of the twentieth century? Similar neglect has been shown in the broad field of mechanical and electrical engineering; whose pioneers have surely lain long enough in their graves to give an appreciative public time to determine to whom it should first erect its commemorative marbles.

We cannot be accused of being a people averse to the building of commemorative works, whether in the form of shaft, tablet, or statue; as witness the lavish hand with which the cities of the country and its battlefields have been adorned with memorials of our leading military men. Unfortunately, our work in this direction has been very much out of balance; and for one monument raised to men who have done service in the arts of peace, we may find fifty devoted to those who have gone forth to war. But perhaps the recent unveiling by the people of the city of Trenton of their statue to an engineer, whose fame was wider than any city or municipality could contain, may prove to be a suggestion that will bear fruit in the addition to the tributes to Ericsson and Holley, of others to men whose services were none the less distinguished because they were but little heralded.

## INTERNATIONAL ELECTRICAL UNITS.

To secure the better definition of international electrical units and standards is the main reason for an international electrical congress, which will convene at London on October 12. Since the electrical congresses of Chicago in 1893 and of St. Louis in 1904, the subject of units and standards has been under the careful consideration of leading physicists and electrical engineers, and much experimental work has been carried on in various national and other laboratories with the object of obtaining data which would lead to the amplification and more accurate statement of the definitions adopted at Chicago. In the interval since that congress, each investigator concerned has been most anxious to introduce every possible refinement into his work, as any new decisions must be based largely on experimental evidence. At the St. Louis congress the delegates considered that the question could not be settled then by direct legislation, but should be considered by experts and taken up by a subsequent congress. First suggested for 1906, the coming congress has been twice postponed, but now, apparently, matters are in shape to enable it to consider the steps which should be taken to bring about agreement in the definition of electrical units which shall form the basis of legislation in different countries, and in the methods of constructing and employing the electrical standards necessary to give effect to these definitions. In discussing the units and standards the main question will be whether the volt or the ampere shall be recognized as the primary unit with the ohm. For as all electrical measurements are derived from Ohm's law, $I = E/R$, or the intensity of the current varies directly as the electromotive force and inversely as the resistance, if we have any two of these units we can derive the third. Now it is universally agreed that the ohm, or practical unit of resistance, shall be one of the primary units, but when it comes to the other there is a difference of opinion as to whether it should be the ampere, or unit of current, or the volt which is the unit of electromotive force. These practical units are all defined in terms of the C. G. S. or absolute system, but this is purely theoretical; and just as we refer to a certain platinum-iridium meter bar as our standard of length, so in electricity we must have certain standards that actually realize any definition adopted. Thus for the ohm there is little difficulty in realizing the definition of the Chicago congress, that the international ohm, based on $10^9$ units of resistance of the C. G. S. system, should be represented by a column of mercury at 0 deg. C., 14.4521 grammes in mass, of constant cross-sectional area and 106.3 centimeters in length. But the Chicago congress also defined the ampere as the current depositing 0.001118 gramme of silver under specified conditions in a coulometer or silver voltameter, and the volt as 1000/1434 of the electromotive force of a Clark cell under standard conditions. These separate definitions of the ampere and volt, however, did not meet with universal acceptance, and in several countries other definitions legally were authorized. In the meantime the coulometer was subjected to further investigation as well as the Clark cell, while the Weston cadmium cell was developed and found superior to the Clark in several important particulars. In fact, those working with the standard cells pointed to their greater accuracy and reproducibility, and urged that the volt as thus defined be taken as the fundamental unit. In behalf of the American physicists this view was vigorously presented at a meeting of representatives from various national laboratories and bureaus of standards which was held at the Reichsanstalt at Charlottenburg near Berlin in October, 1905, by Prof. H. S. Carhart, and backed by additional arguments the claims of the standard cell will again be urged at the coming congress. While the conference at the Reichsanstalt was informal, yet it passed resolutions recognizing the ohm and the ampere as the fundamental units, and recommended that the Weston cell be adopted as the standard of electromotive force, but without any value of its E. M. F. being specified in any legislative enactment. Further, it was recommended that at each national laboratory standard ohms realizing the international definition should be constructed, while at the same time a technical commission should be appointed to prepare detailed specifications for realizing the definitions adopted by the next congress. These decisions simply presented the questions in a concrete and direct form, which has been embodied in the formal programme for the London congress.

Accordingly, this body will be concerned largely with the discussion of the following propositions:

1. That the ohm shall be the first primary unit.
2. That the ampere shall be the second primary unit.
3. That in consequence the volt shall be treated as a secondary or derived unit.
4. That the international ohm shall be defined as the resistance at the temperature of melting ice of a column of mercury of uniform cross section terminated by planes at right angles to its length 106.3 centimeters in length and 14.4521 grammes in mass.
5. That the international ampere be defined as the unvarying electrical current which, when passed through a solution of nitrate of silver in water, deposits silver at the rate of 0.001118 gramme per second.
6. That the international volt be defined as that E. M. F. which when applied steadily between the ends of a conductor of resistance 1 international ohm produces a current of 1 international ampere.
7. That the Weston cadmium cell be adopted as a convenient standard of E. M. F.
8. That specifications dealing with the methods of setting up mercury standards of resistance, of realizing the ampere by the deposition of silver, and of preparing standard cells be issued with the authority of the congress, and that for this purpose a technical commission be appointed to prepare these specifications.
9. That the congress consider and advise as to the best method of securing uniformity with regard to the fundamental electrical standards in the future.

While it is earnestly to be hoped that the American view of the volt and standard cell will prevail in the congress, yet in any event considerable progress is to be expected toward putting electrical standards on a more accurate basis, even if the matter of permanent definitions is not settled, but referred to a technical commission for further investigation.

## IMPROVEMENT OF NEW YORK-NEW JERSEY SUBURBAN SERVICE.—II.

ERIE RAILROAD.

In our issue of June 20 we published the first of the present series of articles on the important improvements which are being made in the railroad terminals in Jersey City and the approaches thereto, with a view to facilitating the movement of the ever-increasing number of trains, both suburban and long-distance, which make use of these terminals. In that article, which dealt with the improvements of the Delaware, Lackawanna & Western Railroad, it was shown that, in addition to an entirely new terminal and ferry-house, the company had built an additional two-track tunnel through Bergen Hill, parallel to its old tunnel, thus doubling at once the capacity of its tracks at that point. The Erie Railroad, which has been perhaps even more hampered by scarcity of tracks, is making larger additions than the Lackawanna Railroad; for it is now engaged in excavating a huge four-track open cut through Bergen Hill, adjoining and parallel to its existing two-track tunnel. Bergen Hill, which is really a continuation of the Palisades of the Hudson, lies about three-quarters of a mile to the west of the Hudson River, and at the point where it is pierced by the present Erie tunnel it averages about 100 feet in height and 4,000 feet in width at track level. Of late years the congestion at the Erie tunnel has become intolerable. It is due to the fact that upon its two tracks has to be carried, in addition to an unusually heavy suburban traffic, both a large through express and a freight traffic. The construction of the new four-track open cut and the rearrangement of the approaches thereto form part of an extensive plan of improvement which will include eventually a new terminal building and ferry-house.

At the present time the two-track tunnel, during the morning and evening rush hours, is reserved exclusively for the use of passenger trains, while during the rest of the day it is used by both freight and passenger trains. The traffic of the Erie road converges to the Jersey City terminal from six different branch lines, which merge to the west of Bergen Hill in three groups of two lines each. The New York, Susquehanna & Western Railroad and the Northern Railroad of New Jersey approach from the north; the main line of the Erie and the New Jersey & New York Railroad come in from the west; and the Greenwood Lake division and the Newark branch from the south. The only possible arrangement by which the traffic of these six roads could be accommodated through the one tunnel was to operate the two tracks in the same direction during the morning rush hours, and allow no trains to travel through the tunnel in a westerly direction. In the evening the difficulty is solved by doubling up the trains and placing two locomotives at the head of them, for the trip through the tunnel. When the point of divergence is reached, the trains are cut in two, and each locomotive picks up its respective part of the train. When the open cut is completed, its four tracks will be devoted exclusively to passenger trains, and the freight traffic will be handled through the existing tunnel. It is proposed to operate three of the new tracks in one direction, and the fourth in the opposite direction during the rush hours, and to operate two of the tracks in each direction during the hours when traffic is lighter. Under this arrangement three trains will be able to enter or leave the terminal abreast of each other, and the tracks on the farther side of Bergen Hill have been so rearranged that these trains will be able to proceed to their respective destinations without interfering with each other, or with the inbound trains coming over the fourth track.