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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.

A CITY OF TOWERS.

Within the past few months we have illustrated on the front page of this journal two office buildings, both in course of erection, which are to considerably exceed half a thousand feet in height. Both of these structures are built as additions to existing office buildings, and the predisposing motive in carrying them up to such unprecedented heights is the desire to obtain a maximum amount of office space on a given amount of ground area. Incidentally, in the case of each building the publicity afforded by such towering structures has also been no inconsiderable motive. But whatever may be the *raison d'etre* of these office towers, there can be no question that the skyward race having begun with such daring aspiration, other builders will be seized with the vertical "speed madness." And so we may look to see a repetition of the tower-building craze of medieval times, which led the wealthy men of Siena and Bologna to build those curious and not unsightly shafts, which form one of the historical and architectural attractions of those cities.

If it should prove that we are to witness an era of tower building in Manhattan, the question arises as to what limits of a physical character exist which must set a limit upon height, always supposing that the municipal authorities impose no restrictions by law. Judged from the standpoint of structural engineering, there is no reason why, if any firm were desirous to have it done, an office building should not be run up to a height of 1,000 feet; provided, of course, good rock foundation were found. It would merely be a question of enlarging the section of the columns, and introducing a system of completely triangulated trussing, which would probably, at least in the lower half of the building, have to extend entirely around the four sides of the tower at every floor. In the present state of the art, the limit upon height would be imposed by the elevator question. For unless some lighter and more speedy system should be devised, it would be necessary to make the full ascent of a thousand feet in three distinct flights. Moreover, the large amount of space that would have to be given up to elevators would make such serious inroads on rentable floor space, as to render it necessary, if any reasonable profit were to be made upon the venture, to charge prohibitive rentals.

NAVAL MARKSMANSHIP.

It seems like a truism to state that the man behind the gun is the most important factor in the efficiency of a warship; and yet, the fact that it is only of recent years that training in marksmanship has received adequate attention, would seem to show that the supreme importance of the gunner is only now being fully understood. The improvement in marksmanship in our own navy has been enormous since the Spanish-American war when, as was pointed out in this journal at the time, the number of hits at the battle of Santiago was only two per cent of the shots fired. It is safe to say that under present conditions of marksmanship, our gunners would have placed the figures at nearer twenty than two per cent.

The Japanese, in repelling the sortie of the Russian fleet at Port Arthur, did some very indifferent shooting; but, profiting by their experience, they put in an enormous amount of target practice in the interval between that engagement and the great fight of the following May, when the 12-inch guns of Admiral Togo's battleships were credited with making nineteen per cent of hits out of the total number of shots fired. In the British navy there has also been a notable improvement, and some brilliant records have been made, there being, in fact, quite a neck-and-neck race between the gunners of that navy and our own for the world's record. The British Admiralty has recently published a table showing the results of the gun layers' test in the fleet for the year 1906, and the high average of hits made is compared with the results in five previous years during the decade. Thus, comparing the years 1897 and 1906, the percentage of hits to rounds fired in 1897 was 31.83; in 1904 it was 42.83; in 1905 it reached 56.58, and last year it rose to 71.12. Under the table of hits per gun per minute we note that for the 10- and 12-inch guns, the figure rose from 0.09 in 1897 to 0.81 in 1906. For the 9.2-inch gun there was recorded in 1897, 0.17 hit per gun per minute, and this had risen in 1905 to 1.40, and in 1906 to 2.84 hits. The 6-inch gun averaged 1.33 hits per gun per minute in 1897, 2.23 hits in 1904, and 4.96 hits per gun per minute in 1906. The record for the whole navy for the year was held by the cruiser "Drake," which brought Prince Louis of Battenberg to this country in 1905. On this ship with the 9.2-inch gun, seventeen hits were made out of eighteen rounds at a moving target, and in one minute eleven hits were made out of eleven rounds with a 6-inch gun.

ELECTRIC TRACTION VINDICATED.

It would be a thousand pities if the recent derailment of an electric train on the New York Central tracks should serve to shake the faith of the public in electric locomotives and electric trains, or delay the application of electric traction to the railroad system of this country. Absolutely nothing has transpired thus far in the investigations to show that the disaster was due to the electrical equipment, as such. In our recent editorial on the "Peril of the Electric Locomotive on Steam Roads," there was no intention, nor was there any effect, of creating the impression that the fine electrical equipment, both of the New York Central and the New Haven lines, was defective, or that the "peril" lay in the mechanical features either of the line, the locomotives, or the general rolling stock. On the contrary, as far as the electric appliances are concerned, the results of the accident were a vindication of its efficiency; for it is a fact that the instant the train was derailed, and the third rail broken, the automatic cut-outs operated instantly, and that particular section of the line where the accident occurred became "dead." No one was "electrocuted" nor was any fire started by short circuits.

What we did say, and what we reaffirm to-day with added emphasis, is that because of the new conditions introduced with electrical traction and inseparable from it, there is a call for higher intelligence and more conscientious care on the part of the operating and maintenance departments in order to meet these conditions. The unusually low center of gravity, the enormous reserve of power, and the capacity for high speeds of the electric locomotive, are not faults, but excellences of the machine. But the low center of gravity and the capacity for high speed call for special conditions in the track, particularly on curves, in order to meet the more severe stresses which will inevitably result. It is highly creditable that the designers of the electric locomotive should have succeeded in providing, in an engine of the same or even less total weight than the steam locomotive, a power and speed capacity so very much greater. The peril lies not in the machine but in the man, lest through ignorance or lack of judgment, he should draw upon his reserve too freely and drive his train at speeds far beyond the limits of safety for the particular stretch of road over which he may be running.

The evidence which has been brought out thus far in the investigations confirms our opinion that it was the under-elevation of the outer rail combined with the unquestionably excessive speed of the locomotives that sheared the spikes, flung the rail aside, and allowed the cars to run wild over the tracks. For many years this journal has been advocating the use of greater super-elevation of outside rails on curves. We believe that in the practice of under-elevation lies one of the greatest perils of present-day railroading, and that the coming introduction of electric traction, with its inevitably higher speeds, intensifies this danger enormously. The only plausible objection to high super-elevation is that when slower trains, and especially freight trains, pass around highly super-elevated curves at low speed, the additional weight thrown on the lower rail tends to batter it down and cut the ties badly. Granted. But is it not better to wear out ties and rails a little faster and have a track which is safe for every train, fast or slow, than to save a little of the cost of maintenance at the risk, the enormous risk, of human life entailed by the present execrable and ridiculous practice of running express trains at from thirty to fifty per cent higher speed than that for which the track is super-elevated?

It was testified before the coroner that the curve at Woodlawn was elevated to give equilibrium at 45 miles an hour, but that the elevation was perfectly safe for 60 miles an hour, this being said, by the particular witness referred to, to be the common practice among engineers. The fallacy and the peril of such practice, however, lies in the fact that although 45 miles an hour is the mean between 30 and 60 miles an hour, it is not by any means the mean between the centrifugal stresses induced at those two rates of speed; for the centrifugal thrust increases as the square of the speed, and the speed which would give the mean stress on the outer rail would be well on to 55 miles an hour. For such a speed should the rail be elevated, and not for 45 miles, if 60 miles per hour is to be considered the safe allowable limit for that curve.

METALLIC SODIUM AS A CONDUCTOR FOR ELECTRIC CURRENTS.

Metallic sodium was first prepared by the action of a powerful electric current on caustic soda which had been previously considered as an element. It is now prepared by distilling a mixture of sodium carbonate and charcoal. The metal is exceedingly light, having a specific gravity of 0.98, and consequently it floats on water. When freshly cut the surface has a bright, nearly white, metallic luster, and it is almost as soft as wax. When thrown on water it sets up a chemical action with great energy which causes the evolution of hydrogen and finally it ignites. In consequence of this action sodium cannot be kept in the air but must be preserved under oil or in hermetically-sealed vessels.

Such a metal would seem to be the last in the whole list of substances that would be selected as a possible medium for the transmission of electric currents, yet this scheme is now being quite earnestly discussed in electrical circles, due, largely, to some recent deductions and experiments by Mr. Anson G. Betts, which are herewith briefly described.

According to Prof. Francis B. Crocker, the first to suggest the utility and economy of sodium for conductors was Mr. Charles S. Bradley, who pointed out as early as 1897 that a sodium conductor would be much lighter than one made of copper or even aluminium for equal lengths and resistances. Since sodium is so extremely soft and unstable a metal Mr. Bradley proposed to circumvent these untoward difficulties by incasing it in an iron or a steel tube with screw caps at the ends. Now this is exactly what Mr. Betts has done in his experimental investigation of the subject, using lengths of wrought iron pipe approximating 17 feet and having a diameter of 1½ inches. There were ten pipes in all, and it required about 120 pounds of sodium to fill them, which cost approximately 50 cents per pound, although it is stated that sodium can be produced for 7½ cents per pound.

The method employed to fill the pipes with the sodium and to obtain as good an electrical contact between the surfaces of the different metals as possible was to heat the pipe considerably above the melting point of the sodium, and melting the sodium in an iron vessel from which it was caused to flow into the tube. After the sodium and the pipe had cooled a graphite and oil mixture was applied to the ends to make it air and water tight and the sections connected together.

The total length of the conductor was about 130 feet and this was put up outside of Mr. Betts's laboratories and connected two of the buildings. After being in use for several months it was removed and put up in a nearby field in virtue of the additional fire risk it incurred, which was not small, as will be seen.

The advantages of a sodium conductor over those made of copper or aluminium lie in the economy of its installation and in its upkeep; thus a copper conductor that cost $1,000 can be replaced by a sodium conductor for $300; the annual cost for the former being $120, namely $60 for interest and $60 for the loss of energy; the annual cost for the latter would be $78, i. e., $18 for interest and $60 for loss of energy.

A sodium conductor costing $550, however, would be more economical than one costing $300, for this obtains when the interest and the power loss are even or nearly so, that is, the interest would be $33 and the loss of energy $32.75, or a total of $65.75 per year.

Among the disadvantages that can be cited against the use of sodium conductors it may be said that they are applicable only where heavy currents are to be carried. Again it would certainly be unsafe to use them if there was a possibility of fire, for heat would cause the sodium to expand to a point where it would break the pipe containing it so that the metal would burn up; if it were attempted to extinguish the fire with water its peculiar characteristics would result in a dangerous display of hydro-pyrotechnics.

Besides these obvious objections there are several factors that have not been accurately determined which, should these prove unfavorable under test conditions would relegate the sodium conductor to the limbo reserved for all impracticable schemes. One of these unknown factors is whether or not the sodium and iron in contact will not in time set up a chemical action and so decrease the value of sodium as a conductor. Other factors are the relative expansions of sodium and iron, etc.

Mr. Betts has shown that the iron pipe carried 20 per cent and the sodium in the interior 80 per cent of the current. On the assumption that the unknown quantities of sodium will prove satisfactory it will not be at all surprising to learn of a commercial installation of this material at any time.