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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.

LAKE ERIE AND THE NEW YORK WATER SUPPLY.

We have had brought to our notice the general outlines of a scheme for providing a source of water supply that would meet the present and future needs of New York city. We present this scheme here in its broad outlines as being an interesting, and not impracticable, study of a problem which is pressing for solution with an emphasis that increases as the years go by. It is suggested that in the vast body of fresh water, Lake Erie, there is an unfailing supply of good drinking water which can be tapped at an elevation of 580 feet above the sea level. The lake is about 300 miles distant from New York city, and it is suggested that, because of this difference of level, by the construction of a suitable aqueduct or aqueducts this water could be brought to New York city, and delivered under a pressure, approximately, of 200 pounds to the square inch, which is 50 pounds more than the highest pressure under which water is now delivered in the most favored portions of the city. Beginning at Lake Erie, the proposal is to build a suitable intake, which would discharge the water into ducts of steel and concrete construction, the steel furnishing the necessary tangential strength to resist the considerable water pressure. It is proposed to take advantage of the reconstruction of the Erie Canal and lay the ducts along the canal right of way, carrying out this work contemporaneously with the enlargement of the canal. At Schenectady the ducts would leave the canal and be carried in an approximately straight line to New York city. In view of the extraordinary rate at which the population of the city is increasing, the ducts would be built of sufficient size for the delivery of a maximum supply of one billion gallons of water a day, should that amount be ultimately required. The structure would be placed beneath the ground, at a sufficient depth to protect it from injury; and for the greater part of its length, after leaving Schenectady, it would follow the undulations of the ground, and involve a minimum amount of tunneling.

To accomplish the necessary reduction in pressure for city use, both in New York and at the various towns along the route which would also be served by the aqueducts, the water, at points of suitable fall, would be carried through waterwheels, and the power thus generated would be a valuable asset. The passage of the water through waterwheels would accomplish the following result: First, it would reduce the pressure; second, it would aerate the water; and third, it would serve to generate power which could be used for municipal lighting for pumping sea water for fire service, and for other city purposes.

It is suggested that this proposition be intrusted to a competent State commission, with power to regulate the water supply and sewage of any city in the State having 100,000 inhabitants or more, making it optional for smaller cities to be included at their request. It is claimed that by making the question of the water supply, not merely of New York but of the cities that lie within reach of the proposed aqueduct, a State matter, and by carrying it through on the broad lines suggested, the whole question would be simplified, the expense per capita reduced, the cities affected connected with a vast natural reservoir of cold, pure water, placed, as if for the purpose, on the very borders of the State, and that thereby the whole miserable business of the Ramapo water company and other complications of the kind would be swept out of the way for good, and this, the most important question affecting the welfare not merely of New York city but also the other leading cities of the State, settled once and forever.

Among the many plans for water supply that have been suggested during the past few years, this is one which seems to be worthy of more than casual consideration.

The correspondent who sent to this office the pamphlet containing the above suggestions is one of the minority who consider that it is inexpedient to carry out the enlargement of the present Erie Canal, on the ground, presumably, that to render the canal efficient it should be built to a much greater depth than 12 feet. He suggests that rather than spend over a hundred million dollars in deepening the canal, it would be wise to abandon the canal as such, and utilize the present bed for the construction of the proposed aqueducts. At present the canal is 56 feet wide at the bottom, 70 feet wide at the surface, and about 7 feet in depth, which would, with some dredging, provide ample cross section to contain ducts of a total capacity of one billion gallons per day. Although this scheme is impossible for the reason that the State is committed to the widening of the canal, the point is certainly well made that, if the construction of such an aqueduct line were carried on simultaneously with the canal enlargement, considerable economy of construction would be realized.

THE TEMPERING OF BRONZE.

M. Leon Guillet has lately made some experiments as to the effect of tempering upon bronzes. It is known that some kinds of bronze are softened by tempering. On the other hand, M. Riche showed that bronzes which contain a considerable proportion of tin, 15 to 20 per cent, are malleable when hot, while they are brittle when cold. The experimenter wished to find the influence of tempering upon the mechanical properties, using different specimens of metal. To carry this out he submitted bronzes having from 5 to 21 per cent of tin to a tempering which varied in different cases from 300 to 800 deg. C. He draws the following conclusions from these tests. 1. Alloys containing more than 92 per cent copper have their breaking strain increased somewhat by tempering at a low temperature between 400 and 600 deg. The elongation varies in about the same way. 2. For metals containing less than 92 per cent copper, the breaking strain and elongation increase in marked degree when the temperature of the tempering exceeds 500 deg. The maximum breaking strain is reached for all the specimens for a tempering carried out at about 600 deg. On the contrary, the maximum of the elongation seems to vary with the composition of the alloy. It occurs at a tempering of 800 deg. for the bronze containing 81 per cent copper and 19 tin, and at 600 deg. for 79 copper and 21 tin. The difference between the breaking strain of the non-tempered cast metal and the pieces which are tempered at the most favorable temperature is greater according as the proportion of copper is smaller. In general it is to be concluded that the tempering of bronze between 600 and 800 deg. C. brings about much better results as to traction tests. As to the resistance to friction, the effect is to be studied in the further experiments.

SUBURBAN TRAFFIC IN LONDON.

The suburban traffic of the railroads of London has suffered severely from the competition of the street electric railroads of the County Council. The decrease in the number of passengers carried during the past year has amounted in one instance to as many as 2,100,000. In order to combat the effect of this competition, the London, Brighton, and South Coast Railroad have decided to convert a section of their suburban road between Battersea and Peckham Rye, which extends through thickly-populated districts, to electricity. This electrification scheme is the first installment of a complete transformation of the whole of the suburban roads. Owing to the many disadvantages and dangers attending the adoption of the third rail, a single-phase alternating-current system with overhead conductors is to be employed, such as is already in operation on railroads for the local services at Hamburg and Berlin, and similar lines running in Belgium, Bavaria, and Austria. Bare overhead wires and a single high-tension conductor are to be employed. The advantages of this system are greater economy, both in the cost of installation and expense of working and maintenance, since currents can be generated and distributed directly to the overhead conductor without requiring any transformation, thereby dispensing with the erection and maintenance of sub-stations, as well as obviating the losses of energy due to the transformation. The rapid acceleration of electrically-operated trains is so important a factor, that the average speed of suburban trains can be nearly doubled. Moreover, the use of trains with motor coaches at either end makes the total time occupied in getting in and out of a terminus much less than that required for steam trains.

BACTERIAL SOIL INOCULATION FOR VEGETABLES.

The recent announcement in these columns that Dr. George T. Moore, of the United States Department of Agriculture, had dedicated to the public his patents on soil inoculation with bacteria, attracted attention to the results of his work.

The primary object of this investigation of the fixation of nitrogen by the root nodules of legumes was to devise, if possible, some method of bringing about the artificial introduction of the necessary organisms into a soil which was naturally devoid of them, and at the same time to attempt as far as possible to correlate and reconcile the vast amount of conflicting evidence that has been accumulated by various investigators, in regard to the exact nature of the organism where the nitrogen is fixed, the effect upon the host, and similar problems.

The actual benefit of the presence of root nodules upon various leguminous plants has been thoroughly demonstrated by numerous observers both in this country and abroad. The early work of Helriegel and Willfarth, together with that of Lawes and Gilbert, and of Warington in England, and of Atwater and Woods in this country, was quite sufficient to demonstrate the close connection between the fixation of nitrogen in some way by the plant and the presence of the tuber-like swellings on its roots, and there are few, if any, who would maintain that this peculiar function is not under most circumstances distinctly beneficial.

Hundreds of examples can be cited, demonstrating the great benefit which a leguminous crop has upon the succeeding crop. From these we can easily see that it is the almost universal belief, as the result of definite experiments, that a leguminous crop is equal to a considerable amount of nitrogenous fertilizer, and that the crop which follows the legume is benefited to a marked degree. It has been found, however, that although in a great many instances the organisms producing nodules are naturally abundant in the soil, and the mere planting of the legume seed is sufficient to produce a crop capable of fixing nitrogen, there are also some localities which are devoid of the necessary bacteria, and in such places the leguminous crop is of no more benefit to the soil than the corn or wheat or other crops, whose yield might be a greater source of revenue.

It therefore has become necessary to devise some means of artificially introducing into the soil the nodule-producing bacteria, and naturally the simplest means of accomplishing this has been to transfer earth known to contain the proper organisms and capable of producing nodules, to the fields where it was desirable to introduce such bacteria. This soil inoculation method is one which has been practised widely both in this country and abroad, ofttimes with the best results, but not with universal success. In order to escape the difficulties involved in the above-mentioned method, Nobbe conceived the idea of bringing about inoculation by means of pure cultures. This was to be accomplished by isolating from the nodule, by means of a gelatine plate, the right organisms and then transferring to tubes or bottles containing nutrient agar. To this culture of nodule-forming bacteria was given the trade name of "nitragin." Seventeen different kinds of nitragin were prepared from the nodules of as many different plants, and arrangements were made to have them put up on a large scale and placed upon the market by a well-known firm of manufacturing chemists. Experiments with nitragin in Germany met with varying degrees of success. In some instances its use seemed to produce an abundant formation of nodules, while in other cases no benefit could be obtained. In this country the results were very uncertain. Consequently, even though this preparation has been found to be satisfactory in Europe, the necessity for devising some method of producing nitrogen-fixing nodules, free from the objectionable features of transferring soil, remains the same. For this reason, the Laboratory of Plant Physiology of the Department of Agriculture undertook a scientific investigation of the root-nodule organism, and as a result it is believed that a thoroughly practical and satisfactory method of bringing about artificial inoculation has been devised.

There has been the widest difference of opinion as to the morphology and life history of these bodies. It has been determined that the nodule-forming organism is a true micro-organism having three well-defined stages, consisting (1) of minute motile rods which produce the infection, and frequently form zoogloea masses; (2) larger rods either motile or non-motile, and (3) capsulated forms, the so-called "branched organisms," which are made up of two or more rods held together in a sheath. Further, there is but one species of legume organism—*Pseudomonas radicicola* (Beyerlinck) Moore. The difference in the infective power of bacteria from different posts is due to slight physiological variations, which can be broken down readily by cultivation.

The usual method of growing a nodule-forming organism has been to make a medium from a decoction of the particular legume upon which the organism originally grew. As a result of numerous trials, however, it has been found that although the bacteria increased most rapidly upon a medium rich in nitrogen, the resulting growth is usually of very much reduced virulence, and when put into the soil these organisms have lost the ability to break up into the minute forms necessary to penetrate the root hairs. They likewise lose the power of fixing atmospheric nitrogen, which is a property of the nodule-forming bacteria under certain conditions. This condition was met by using an agar for plating out from the nodule to which no nitrogenous salt was added, the usual combination being 1 per cent agar, 1 per cent maltose, 0.1 per cent monobasic potassium phosphate, and 0.02 per cent magnesium sulphate to 100 cubic centimeters of distilled