The New York Zoological Park

One of the World's Most Notable Institutions

By Dr. R. W. Shufeldt

ALTHOUGH not possessing the acreage of the National Zoological Gardens at Washington, the New York Zoological Park here to be described ranks it many times in every particular pertaining to one of these important institutions.* In the first place, it is far better taken care of financially; and to maintain a great park of this kind as it should be done the matter of sufficient money is the all important factor. Added, then, to its wealth, we find skillful and judicious directorship, and a most superb collection of rare and valuable animals brought together from all parts of the world. Finally no zoological garden known to me possesses such elaborate and substantial buildings as does this one nor more attractive and tastefully laid out premises. Indeed, it is scientifically equipped in all particulars, and represents the highest possible standard with respect to capable management and far-reaching educational achievement. It is truly marvelous what the authorities have accomplished in all directions since the Legislature of New York State granted, in 1895, a charter for the incorporation of the New York Zoological Society, in which body this park found its origin.

The society now numbers over two thousand members; and it was not until three years after its incorporation that it assumed control of this enterprise, the first building undertaken being the Bird House (August 11th, 1898); the construction of the Wild-Fowl Pond was commenced only a few days thereafter. It was fortunate that, in the early administration of its affairs, an arrangement was arrived at through which all net profits from all sources, as its restaurants, riding of animals, sale of guide and other books, boat hire, photographs, and other revenues formed a common sum, every cent of which was to be used for the purchase of new animals for the collection. This accounts for the wonderful accessions that are constantly being made along these lines; admission fees, guide-books and photographs alone realize a very tidy sum annually, to which, be it said, through mismanagement in these matters, much of the poor showing of other gardens is due. Of the 264 acres comprising this Garden, there are about 34 acres in water surface, which include the ponds, and the Cope, Agassiz and Bronx Lakes. The Park is most conveniently situated in the northeast part of the city, being readily accessible by several lines of cars and broad highways for automobiles and other conveyances. It is no wonder, then, notwithstanding the fact that two days in the week an admission fee of

25 cents for adults and 15 cents for children under twelve is charged, that thousands of visitors pass through its gates annually, many of them purchasing the "Guide Book" at a cost of 25 cents per copy. This little book almost possesses the rank of an elementary treatise on general zoology, in so far as brief life-histories of animals are concerned. It is one of the most complete books of its kind ever published, and of inestimable value to the visitor who goes to the

trees, and nearly forty species of shrubs, all of which, as well as the flora of the place, is under the constant care of an experienced forester and botanist.

It would certainly be highly detrimental to the health of this estimable officer should he live to see, in the scientifically kept grounds of this park, the scenes to be witnessed in the National Zoological Park at Washington on "Easter Monday," when thousands of negro children with their parents and others, many half-blood, and a fair percentage of whites, resort there to roll eggs down the "Mammal-House Hill." It will not be necessary for me to describe the plant destruction that takes place on this "red-letter day;" it can be easily imagined, and space will be saved through the non-description of the scenes that follow such a barbarous practice.

Speaking of the beautiful plant growth in the Bronx and the grand forests to be found there, Doctor Hornaday tells us that "It is safe to say that nowhere else within fifty miles of New York can there be found any more beautiful forests than those in the central and eastern portions of the park. Throughout the inclosed grounds it is absolutely necessary that visitors should be restricted to the walks; for otherwise the feet of our millions of visitors would quickly destroy every ground plant." (Guide-Book, p. 23.)

It is truly marvelous what has been accomplished since this enterprise was first launched. In only a few years, comparatively, through the unstinted financial aid of New York city, Doctor Hornaday's persistent push and exceptional knowledge of requirements, and the general management, we now have a garden, from practically a primeval tract of land, which possesses no rival anywhere in the entire world; and for botanical features, beauty of design, general attractions, and a thousand interests along other lines, it is simply a marvel. There are over a dozen structures absolutely palatial in their designs and in the grandeur of their immediate surroundings. Among these are the Elephant House, the Lion House, the two buildings for birds, several buildings for different species of

mammals, the Administration Building and the Reptile House. More than \$2,000,000 has been expended by the city in assisting to erect these modern animal palaces; and in addition to these modern, upward of thirty other buildings, ponds, pools, paddocks, and the rest, with others for winter-quarters, boat and store houses. Many of these are to be seen in the reproductions of the photographs illustrating the present article; and I may state that there are no buildings of the kind to equal them in any zoological garden, either in the Old or the New World.

Another item to be considered is the fact that the Zoological Society, to help along the development of this grand institution, has added over half a million

Plan view of the New York Zoological Park.

park, not only to see the animals but to study them intelligently.

Every manner of convenience is supplied by the authorities and management of this institution; indeed, anything which may conduce to the comfort of the visiting public is at hand. There are wheeled chairs for those desiring them; a first-class restaurant, and a charming sheet of water in Bronx Lake for the use of excursionists and boating-parties, with every facility to enjoy it. The park is nearly a mile in length, and three-fifths of a mile in width. About one-third of this is covered by a magnificent forest of more than a dozen different varieties of trees, including five kinds of oaks, to say nothing of the elegant hickories, gums, tulip-

*The map and all of the illustrations used in this article are copyrighted by the New York Zoological Society, and their use in the present connection has been courteously allowed by Doctor Hornaday and the aforesaid society—a privilege not to be extended beyond their appearance here without the issuance of a similar permit.—R. W. S.

more dollars to the fund; in fact, the financial resources of this park are practically limitless—hence the exceptional beauty of its grounds, its extraordinary structures, and its long list of all kinds of animals from all quarters of the globe.

Seven or eight years ago there were upward of 6,000 specimens of animals in the collection, and these were constantly being added to by purchase and by donation.

Personally, I am most emphatically of Doctor Hornaday's way of thinking when he says: "For humane men and women there is small pleasure in the contemplation of living creatures that are in prisons, and that look and feel like prisoners, pining behind their bars. Better no 'Zoos' and no wild animal collections than miserable and unhappy prisoners. A *badly-made* or *badly-kept* 'zoo,' or *zoological garden or park*, is *worse than none*. But, at the same time, it is folly for any one to say that all zoological gardens and parks are dens of cruelty, as is held by a few extreme humanitarians. The creatures in the collections of the Zoological Park give unimpeachable testimony to the contrary. If our bears, our hoofed animals, our birds and our apes and monkeys are not positively happy, and full of the enjoyment of life, then none are in this world, either captive or free. To-day the life of every free wild creature is constantly filled with alarm, with flyings from danger, and with the daily struggle for food, water and safety. Every hunter knows that after every mouthful of food, the wild animal or wild bird looks about for dangerous enemies; and the ultra-humanitarians take small note of the millions of wild lives that are pulled down and destroyed by predatory enemies."

With this small city of elegant animal buildings and other structures; its superb and costly grounds, and with all its money, no one will wonder when I say

that as to the animal collection itself, for the exhibition of which all this outlay has been made, no one can have any conception of its comprehensiveness or its extent unless he has studied it in its entirety. There are hundreds of forms represented from every department of the vertebrate kingdom. Some are extremely rare; others are upon the verge of extinction, and many are not to be found in any other zoological garden of the present day. This garden so far outranks every other institution of its kind in the world, that to dwell on that point would be to use valuable page-space to no practical end.

This Zoological Garden does more, however, than to simply place all these fine and rare animals on exhibition; for it either directly publishes—or indirectly assists in publishing—bulletins, books, circulars, and various other publications, magnificently illustrated, which are classics in their way, and which have had a tremendous influence in spreading zoological knowledge everywhere among the people of this country and abroad.

Still, it may safely be said that the work of the New York Zoological Park, and of the Society under whose control it is, has hardly more than just begun what it is so well fitted to achieve in the future. Fortunately, it enjoys the confidence of New York city and State, with all the wealth they can pour into its treasury. There are two lines of endeavor and research now open for this powerful organization to enter upon: one is to widen and energetically push all that leads to the protection and increase of the rapidly vanishing wild life of North America. It has already done something in this field, but it can do a great deal more which will rapidly show worthy results. It can only be through wise laws made along strictly scientific lines, and through the persistent efforts of such a society as I have attempted to describe here, that many of our

fish, reptiles, batrachians, birds, and mammals can be saved from utter extermination in the comparatively near future. Remember the millions of wild pigeons we had not half a century ago—and now we have *none*. Other forms are being just as rapidly exterminated in this country by man as were those beautiful birds.

Another line of work to which the society and park should devote itself is the establishment of a thoroughly equipped prosectorial department, for the study of the morphology or anatomy of all the animals that die in the collections. This will require not only exhaustive prosectorial work, but the establishment of a fund to handsomely publish the results of such labors and researches. A great many of our animals of all classes are now passing rapidly away, and will soon be entirely extinct. If the structure of these is not studied and published in detail by the anatomists of the present time, the day will come when the morphologists of future generations will have good cause to say what they think of us and of our culpable neglect in such important fields. This entire department of science is now being sadly neglected in this country; and as I look back over the past forty years or more, I think of the correspondence I had with such workers in this field as the Parkers, Huxley, Forbes, Darwin, Sir Richard Owen, Cope, and many, many others of similar standing—men who never allowed a year to slip by without publishing their memoirs upon the comparative anatomy of some of the vertebrata and who powerfully increased our knowledge of such subjects. In these matters we have fallen far behind what was being accomplished during the latter half of the last century. Will it not be possible for the New York Zoological Society to revive the interest in these fields? With its unequalled facilities to prosecute such work, its unrivaled means, and its weighty influence, it most assuredly can do so.

“Pupinized” Telephone Lines

An Invention by Means of Which Telephone Conversations can be Carried on Over Long Distances

By Francis B. Crocker

ALTHOUGH the invention of the “Pupinized” telephone line was made fifteen years ago, and is often mentioned in papers relating to electrical matters, it has rarely, if ever, been described, except in very technical terms, although it is a matter of great general interest, as by this invention a problem of great practical importance is solved in an entirely scientific manner; in fact, it is a noteworthy example of obtaining great practical results from purely *a priori* reasoning. The problem was conceived, and largely worked out, by theoretical calculations before any experiments were made, even in the laboratory. In spite of its great importance and peculiar interest, the principles upon which this invention is founded and its real nature are often misunderstood, even by those otherwise well informed in electrical matters, and consequently the following description is presented in as popular language as the subject permits.

This invention was publicly described to the American Institute of Electrical Engineers by Professor Pupin in May, 1900, but was conceived and developed by him some time earlier. The principal object of the invention is to conserve the amplitude and form of the electrical waves corresponding to human speech when they are transmitted to considerable distances by conductors, especially underground and submarine cables. In this way the distance at which intelligible telephone conversation may be carried on is increased. The Pupin invention of “loaded lines” is often supposed to depend upon the neutralization of their electrostatic capacity by introducing inductance coils along such lines. This principle does apply to his pioneer work in electrical resonance, and in tuning circuits to make them responsive to a particular frequency of alternating current. But it does not, however, apply to “loaded” or “Pupinized” conductors. Indeed, the condition of resonance is avoided in the latter case, and a relatively large amount of inductance may be advantageous, especially for long lines, provided excessive resistance, hysteresis and eddy current losses are not introduced at the same time.

The simplest analogy to Pupin's invention is the fact that a projectile must have considerable mass in order to overcome the mechanical resistance of the air and travel a long distance. Similarly, a conductor must have electromagnetic mass, or inductance, in order that an electric impulse or wave may overcome the electrical resistance and travel a long distance. It is necessary in the case of the conductor to *distribute* the inductance along the path of the electric impulse

or wave, hence the phenomenon is more closely analogous to that of a long cord stretched between supports, which must have distributed mass, that is to say, it must be a fairly heavy cord in order that mechanical vibration or waves may be propagated to a considerable distance along it. In the case of the electrical conductor, for example, a telephone line, it is not convenient to distribute the electromagnetic mass or inductance *uniformly*, so that it is introduced in the form of inductance coils placed at certain intervals throughout its length. This corresponds to the mechanical fact that a light cord with distributed weights attached to it is practically equivalent to a heavy cord. Pupin determined by calculation and by experiment that the distance between the coils, like the distance between the weights, must not exceed a prescribed amount in each particular case. That is to say, there must be at least a certain number of coils per wave length in order to approximate a uniformly *distributed* inductance, otherwise they may do more harm than good. Moreover, the shortest wave length must be considered. In telephony the highest frequency necessary to transmit articulate speech is about 1200 waves per second. This corresponds to the upper harmonics or overtones in some of the consonant sounds. Hence the wave length at this frequency is calculated for the given conductor, together with the loading coils, which have a certain total resistance, capacity and inductance that is assumed to be uniformly distributed. As demonstrated by Pupin, in a conductor having not less than eight or ten of his coils per wave length, this assumption is approximately correct. To arrive at these facts Pupin devised new mathematical methods, and solved the various problems in a most thorough and exact manner. He also made experimental tests upon artificial as well as actual telephone lines and underground cables which fully confirmed his theoretical investigations.

Pupin further showed how to design the coils for loading lines in order to obtain maximum inductance with minimum resistance, hysteresis and eddy current losses. In fact the practical success of his system requires that these losses be reduced to a minimum, and this was accomplished by ingenious and careful construction.

The Pupin “loaded line” permits higher voltage to be applied to it, whereby the electrical waves may be transmitted to a correspondingly greater distance. In the transmission of electric power it is sufficient to use 110 or 220 volts to supply motors locally. For long

distances electrical pressures are raised to 100,000 volts, or even higher. In an analogous manner higher voltages applied to “Pupinized” lines increase the distance at which telephonic communication may be practically carried on. If the voltage were raised on an ordinary unloaded line the current would be proportionally increased and the losses would rise in even greater proportion. The losses would also be aggravated if resistance were introduced to limit the current. On the other hand, the introduction of inductance coils adds to the reactance of the line so that the current is not excessive even with a higher voltage. This reactance simply stores the energy momentarily and returns it, but does not itself increase the losses. There is a certain amount of loss in the resistance and iron cores of the coils, but this is relatively small compared with their reactance.

The industrial application of “Pupinized” lines has been remarkably successful and important. In the United States the American Telegraph and Telephone Company purchased Pupin's inventions in this field, and has “loaded” many thousands of miles of overhead and underground telephone cables with Pupin coils. In many cases the cost of the large conductors, as well as their excessive weight and bulk, would be practically prohibitive if it were not for the saving in the size of wire that is secured by Pupin's invention. This applies particularly to the very important telephone lines that have been laid underground between Washington, Philadelphia, New York and Boston in order to avoid the danger of interruption of overhead service by severe wind or sleet storms. There is a **practical limit** to the distance to which speech can be successfully transmitted by underground or submarine cables. For distances of fifty miles or more copper conductors of such large size would be required that their cost would be so high, and they would require so much expensive insulation to cover them, that the investment would become excessive. Moreover, the very object of using large conductors is to reduce their resistance and thereby make up for the relatively high electrostatic capacity of underground or submarine cables. At the same time these large conductors would have correspondingly greater electrostatic capacity, which calls for still lower resistance, and so on. In short, the remedy itself increases the trouble so that still more remedy is needed, which further adds to the difficulty, and the situation appears to be hopeless. Fortunately, the “Pupinized” underground or submarine cable may have conductors of moderate size, because their resistance does not have to be reduced to an extremely low value to make up for the high electrostatic capacity. The latter is practically inevitable when conductors are laid under ground or under water, due to the condenser effect between the conductor and the earth or water, as well as the sheathing usually applied to such cables. In accordance with the Pupin invention the electrostatic capacity is not neutralized but overwhelmed by introducing large inductance. Hence the above-described conflict of conditions is avoided.

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Photo by Courtesy of N. Y. Zoological Society.

The spacious bear den and some of its inhabitants.

THE NEW YORK ZOOLOGICAL PARK.—[See pages 358-61.]