SCIENCE

FRIDAY, MARCH 9, 1888.

THE ADDRESS OF Maj. J. W. Powell on evolution in civilized man, delivered before the Anthropological Society of Washington on Tuesday evening, a full abstract of which is given in our Washington letter, will be found interesting and important. It will be seen that Major Powell rejects the doctrines of evolution as applied to the development of civilized man by the Spencerian school of philosophers. He presents his argument in his usual lucid and forcible manner, and illustrates each point copiously. This address is more popular in its character than either of Major Powell's previous papers on the same subject, but as a scientific discussion of an important scientific question, it is, in our estimation, the best of the series.

THE LATEST REPORTS received by the Hydrographic Office about the logs of the great raft abandoned south of Nantucket about two and one-half months ago, prove, that, though they are now widely separated, their general drift has been in an east-south-east direction, the logs being found a little to the southward of this line. That they were not carried more to the northward and eastward by the Gulf Stream, as would be expected, was probably due to the strong north-west winds which prevailed during the latter part of December and the first part of January. Fortunately, no vessel has been disabled by collision with them, although the German bark 'Bremen,' which was in company with the logs for five days, in latitude 39° north, longitude 62° west, had her sheathing torn and rudder injured.

THE NEW YORK ACADEMY OF SCIENCES was organized in 1817 as the Lyceum of Natural History. It is fourth in point of age among American scientific societies. The name and constitution were changed in 1876. 'The Annals,' begun in 1824, have been distributed in all lands, and have given world-wide reputation to the society. The Transactions, begun in 1881, give a record of the meetings, papers, and discussions, are published in monthly or bi-monthly numbers, and make an octavo volume each year. The library now numbers over eight thousand titles, and is especially rich in sets of the publications of foreign societies. It is now on deposit in the Library Building of Columbia College, and is accessible to the public from 8 A.M. to 10 P.M. every day of the year except Sundays. The cabinet was destroyed by fire in 1866. Previous to that date it was the principal collection in the city, and did a noble work. The academy has long looked forward to the time when it could secure a building of its own, such as the corresponding societies in Boston and Philadelphia have long enjoyed. It is not to the credit of New York that its oldest scientific organization, after nearly three-quarters of a century of steady and persevering activity, should be still unprovided with a building, while many other cities can show noble monuments of scientific interest and public spirit. Why should not the recent meeting of the American Association in this city be permanently commemorated by the erection of a fire-proof building for the accommodation of the academy, or perhaps of several other societies under the same roof, — a building which should be at once a benefit and an honor to the metropolis of America? The interest of the community has been aroused and quickened in the direction of science by the meeting of the association, and the Academy of Sciences would now invite the citizens of New York to take a greater interest in its work.

THE NATIONAL ELECTRIC LIGHT CONVENTION.

THE National Electric Light Association met in Pittsburgh on Feb. 21, and continued in session for three days. The association is mainly made up of representatives of the various arc lighting companies and of the alternating system of incandescent lighting. As Pittsburgh is the headquarters of the Westinghouse Company, and as the Westinghouse Company practically represents just at present the alternating system of electrical distribution, the investigation and discussion of the system occupied a considerable part of the time of the convention, although a couple of papers were read on underground electrical conductors, and other subjects were discussed which will be mentioned below.

The most important paper was by Mr. T. C. Smith, the title being 'The Distribution of Electricity by Alternating Currents.' The alternating system, briefly, consists in distributing the alternating currents at high potential, reducing to the low potential necessary for safety and for the running of incandescent lamps, by means of 'transformers,' — that is, induction-coils working backward, — changing high-potential to low-potential currents. Mr. Smith's paper gave the practical experience he had gained in working with the system, and very frankly told some of the difficulties he had met. With regard to the best way of running the circuits, he says, "The general question as to whether it is better to use separate circuits for separate machines, or to couple them into a general set of 'bus' wires and distribute from them, is too large to be lightly decided; as also is the question as to whether it is best to run separate circuits for separate districts, or to run into a general system of high-pressure mains outside of the station, feeding into these mains at different points, and again distributing from them. . . . There seems to be no doubt that in underground systems the network of high-pressure mains would be best, but for over-head work we have adopted the system of separate circuits from separate dynamos. . . . I now come to the question of the placing of the converters; and for this I think that you may safely lay down the general rule, that, wherever you are simply carrying current, do it at a high potential, and keep your low pressure for purely local distribution. With proper precautions, I do not see that there is any real danger in carrying the high-pressure wires into and through the building. . . . We started in with the idea that it was better, in cases where we had from the number of lights in a building to use more than one converter, to bank them; that is to say, connect all the primaries and all the secondaries in parallel, . . . but two or three peculiar experiences have led us to change our plans, and never to do so if it can be easily avoided."

Following Mr. Smith's paper was one by Mr. Shallenberger, on 'The Energy of Alternating Currents.' The first part of this paper was a description of the ordinary and well-known phenomena of alternating currents: they have been sufficiently described in a former paper in this journal.[1] The following, however, is suggestive: "The question naturally arises, What effect does this new element of self-induction have on the possibilities of practical measurements of alternating currents for commercial work?" The two cases in which the effect is negligible are, 1st, the measurement of the current through an incandescent lamp; and, 2d, the current supplied to lamps through converters with cores far below saturation, and carrying a fair proportion of their full normal load. "There is a third case, however, which arises in practice, in which central station instruments give a somewhat false notion of the actual energy transformed to the circuits; and this is the one in which a large number of converters are connected to the primary circuit, but with the secondaries open." In this case we may have no energy transformed, "while at the same time a considerable reading might be shown on the current instruments."

Now, I have quoted from these papers principally because I wish

[1] Abstract of paper on alternating current motors, *Science*, Feb. 24, 1888.

to point out some disadvantages of the alternating system. The advantages of the system, as allowing the distribution of incandescent lights over extended areas, are so well known, that it is no more than fair that the drawbacks should be recognized, as it is by the honest investigation of every side of a case that science and industries advance. It was pointed out in the paper on motors referred to above, that the energy, being transformed, which is equal to CE, the product of the electro-motive force by the current, could be changed in two ways: supposing E is constant, we can either change the absolute value of C, or we change the position of its maximum with respect to the maximum of E. Now, if the former was what actually occurred, as we decreased the work being done, — turned out a number of lamps, for instance, — we would decrease the current; and the heating of the line wire, equal approximately to $\frac{C_0^2}{2} R$, would decrease in a still greater proportion. But this is not what really occurs. We have only a partial decrease of current, the total decrease being partly made up by a shift of the position of the curve representing C. It was pointed out that this was a disadvantage, as the heating of the line was independent of the *position* of the current curve, depending simply on its *value*. There is another disadvantage in this, which was not mentioned in the paper referred to. A dynamo cannot carry more than a certain current, corresponding to its maximum capacity. Now, if there were absolutely no change in the *value* of the current from full load to no load, it would mean that all of the dynamos in the station would have to be run all the time; for, if we distributed the current among a few of them, they would rapidly heat and burn out. It is evident that this state of affairs would be most uneconomical, since the absolute number of horse-power lost in each machine varies very little with the load, and, besides these losses, we have the depreciation and wear on the machinery. Of course, the engines, supposing there were no lamps being burned, would be doing very little work, running uneconomically. In practice we do not have this state of affairs: the current *does* decrease in value as lamps are turned out in the secondary circuits, but it *does not* decrease proportionally to the lamps turned out, and we must run more dynamos than are necessary to supply the energy required in the lamps; and this at a reduced load, and therefore at a low efficiency. There are a number of interesting points that might be brought out here, but until I have calculated the results of some experiments, and have from them some reliable data as to the magnitude of the different effects, I will not push the matter further.

From Mr. Smith's paper it would seem that the Westinghouse Company have found it best to run the converters separately; that is, not to join a number of them in parallel. Now, the objections to this are, 1st, that it does not allow the converting system to take advantage of the law of averages; and, 2d, that as each converter is only working for a limited time on full load, and as the efficiency on partial loads is not great, the total efficiency is much reduced. As for the first, it is well known that if the total number of lamps in a certain district is, say, 2,000, the maximum capacity of the station required to supply them by a direct system will be very much less, say, 1,000 lamps; this, of course, because all the houses in the district will never have all of their lamps burning at once. If, however, we wish to supply them by converters, using a converter in each house, the capacity of our converters would have to be 2,000 lamps, since any one house might have all the lamps burning on some special occasion. If we calculate the amount of gas we could burn in a month, supposing each jet were burning all the time, and compare with the amount we actually do burn, we will find that we use, perhaps, one-twentieth part of the maximum capacity of our lights. Now, a converter working at an average of one-twentieth of its capacity is not an especially economical machine.

The above considerations must interfere with the economy of the alternating system; still it must be remembered that the system is already successful in so many cases, that, in spite of these drawbacks, the field before it is immense. In Mr. Smith's paper it is especially gratifying to notice how the system has been improved, and is still being improved.

Mr. W. L. Church read a paper on 'Independent Engines for Incandescent Electric-Light Stations,' in which he pointed out, that, when the amount of energy required from an electric-lighting station varies within wide limits, it is better to have a number of small engines to drive the dynamos than one large engine. The reason evidently is, that while a large slow-speed engine is more economical than high-speed engines of smaller size, when both are working at a maximum efficiency, yet our single large engine would only be working at full load for a small part of the day, while the rest of the time it would be doing only a small part of its possible work, and its efficiency would be low. With a number of small engines, on the other hand, when our load decreases, we can shut off some of the engines and dynamos, keeping those that are left up to very nearly their maximum efficiency. Another point in favor of the small engines is, that they may be belted directly to the dynamos, thus avoiding the loss in the countershafting used with the large machine, — a loss that might amount to twenty per cent.

Among the other papers read was a very valuable one on electric motors by Dr. G. A. Liebig; while there were a number of others, all of considerable technical interest.

Pres. J. F. Morrison having declined a re-election, Mr. S. A. Duncan of Pittsburgh was unanimously elected president of the association.

Taken altogether, the meeting was the most important, both as regards attendance and the papers read, that the association has yet held.

WASHINGTON SCIENTIFIC NEWS.

Maj. J. W. Powell on Evolution in Civilized Man. — Ascertaining the Density of the Earth. — Submarine Oil-Springs in the Pacific.

Evolution in Civilized Man.

THE annual meeting of the Anthropological Society was held on Tuesday evening, March 6. Maj. J. W. Powell, the retiring president of the society, occupied the evening by reading a paper, the sixth of a series on the same subject, on the evolution of man.

In the opening portions of his address, Major Powell explained the doctrine of evolution as taught in the philosophy of Darwin and embodied in the phrases 'the survival of the fittest in the struggle for existence' and 'natural selection.' "Nature," he said, "gives more lives than she can support: there are more individuals requiring nourishment than there is food. Only those live that obtain sufficient nutriment, and only those live that find a habitat. Of the multitude of germs, some perish on the rocks, some languish in the darkness, some are drowned in the waters, and some are devoured by other living beings. A few live because they fall not upon the rocks, but are implanted in the soils; because they are not buried in the darkness, but are bathed in the sunlight; because they are not overwhelmed by deep waters, but are nourished by gentle rains; or because they are not devoured by the hungry, but dwell among the living. A few live because they are the favorites of surrounding circumstances. In the more stately phrase of the philosophy of evolution, they are 'adapted to the environment.' Evolution, or progress in life, is accomplished among animals or plants by killing the weaker, — the less favored, — and by saving the stronger and more favored. Many must be killed because there are too many, and so the best only are preserved. Those a little above the average are saved, and this is called 'natural selection.' But this general statement must be followed a little further, that its deeper significance may be grasped."

Major Powell then illustrated the operation of the law of evolution by showing the infinite variety of conditions presented by the earth as the home of living beings, some of the ways in which competition for life is carried on, and the manner in which plants become more perfect, and animals advanced. "The endeavor has been made," he said, "to show what the struggle for existence means, and the part which competition plays in biotic evolution. Competition among plants and animals is fierce, merciless, and deadly; out of competition fear and pain are born; out of competition come anger and hatred and ferocity. But it must not be forgotten that from this same competition there arise things more beautiful and lovely, — the wing of a butterfly, the plumage of the bird, and the fur of the beast; the hum of the honey-bee, the song of the nightingale, and the chatter of the squirrel. So good and evil dwell together."