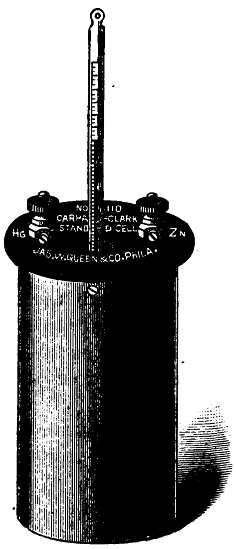
AN IMPROVED STANDARD CLARK CELL WITH LOW TEMPERATURE COEFFICIENT.[1]

LORD RAYLEIGH'S form of Clark cell, described in the Philosophical Transactions for 1885, is the best one hitherto made. The objections to it are, first, that it has a high and variable temperature coefficient; second, it is not constructed in such a way as to keep the mercury away from the zinc when shaken in transportation; and third, an important chemical defect is the local action taking place by which zinc replaces mercury in the mercury salt and the zinc becomes amalgamated, the amalgam often creeping up so as to reach the solder at the copper wire. These difficulties I have, I think, perfectly overcome. I have made cells which have been tested for several months with the low coefficient, at 15° C., of 0.000386 per degree C. At higher temperatures a peculiarity is that this coefficient decreases slightly, while that of Lord Rayleigh's increases very appreciably. The cell is so made that the mercury is confined to the bottom of the cell, or at least, if it does move at all it cannot reach the zinc. These cells have been found to stand transportation exceedingly well.

The same arrangement or device removes the zinc from the mercury salt and perfectly prevents local action. The sealing of the cell is also effected with a more perfect compound. Further,



IMPROVED STANDARD CLARK CELL.

in the preparation of the mercury salt I have succeeded in making mercurous sulphate so free from the mercuric form that it shows no yellowing when washed free from acid. It also remains white upon admixtion with zinc sulphate, and indefinitely, after the cell is set up, provided it be kept out of the light. The light darkens it.

One of these cells has been heated up to 53° C., and the following day it returned to its precise former value of electromotive force at the same temperature. The temperature coefficient given holds at the above high temperature. As indicating the uniformity attained, the last two cells made never differ in electromotive force by more than one part in ten thousand, and usually by only half this, at the same temperature.

[1] Abstract of a paper read before the American Association for the Advancement of Science, at Toronto, by Professor H. S. Carhart.

THE WENSTROM DYNAMO.

THE Wenstrom dynamo, of which Fig. 1 is a perspective view and Fig. 2 a cross section, is well known in Europe, especially in Sweden. It was invented by Jonas Wenstrom, an eminent Swedish engineer, and differs in some respects from other dynamos in the market. It is of simple and substantial construction, as may be seen by the illustrations, and utilizes the magnetic forces to a remarkable degree. It is of the iron-clad type, the armature and field coils being protected by a cast iron shell, parts of which perform the function of pole-pieces. There are four poles, opposite ones being of the same sign, all four being energized by one pair of field-coils, which surround the cores of the inner or horizontal pole-pieces, and are surrounded by the shell which serves as annular cores for the top and bottom field-pieces. Ventilation is provided

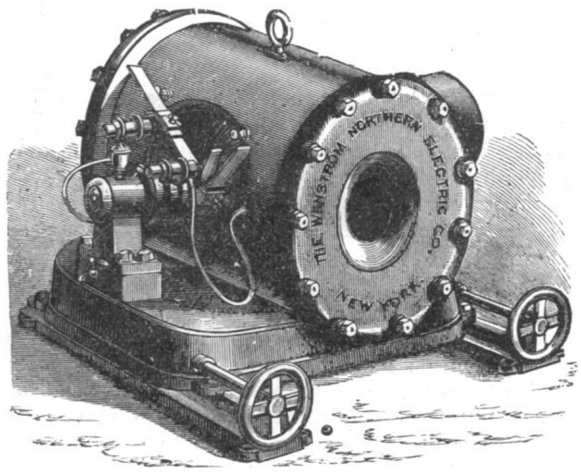


FIG. 1.—WENSTROM DYNAMO.

for by the circular apertures in the shell through which the armature is put into place.

The armature is of the drum pattern, built up in the usual way of thin disks of iron, well insulated, so as to prevent heating from eddy currents. These disks are perforated near the periphery, the perforations being round, ovoid, or hexagonal in shape, and connected with the periphery by a slit, narrowest at the outer part, and only wide enough to admit the winding, one wire at a time. In the grooves formed by these perforations the wire is wound. This peculiar construction admits of the armature revolving in very close proximity to the pole-pieces, materially reducing the resistance of the magnetic circuit, and affording a protection to the armature winding from the effects of centrifugal force, no binding wires being required. A new method of winding is employed, and diametrically opposite sections are connected together, making necessary only two brushes, which are set 90 degrees apart.

The one hundred light machine absorbs eight horse-power, run-

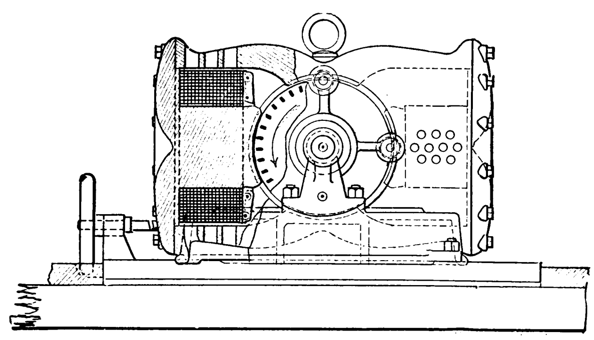


FIG. 2.—WENSTROM DYNAMO.

ning at a speed of nine hundred revolutions per minute. The total weight of the dynamo is eleven hundred pounds, mainly cast-iron, the weight of copper wire on the armature being only thirteen pounds, and on the field magnet cores ninety-four pounds, or one hundred and seven pounds of copper in all. The two hundred and thirty light machine runs at a speed of seven hundred revolutions per minute, its total weight being twenty-five hundred pounds, of which thirty-six pounds are of copper on the armature, and three hundred and eight on the field magnets. The eight hundred light machine runs at a speed of five hundred revolutions per minute.

The advantages claimed for this construction are that there is no waste field, all the magnetic lines of force being utilized in the armature in producing work; neither is there any field outside of the machine which would be liable to affect watches, etc., all the field being contained within the outer iron shell forming the yoke. Low speed in running is obtainable without increasing the size and weight of the machine, and the whole is cheap to construct, and combines features of mechanical strength and solidity with high electrical efficiency. Finally, the machine is remarkably free from any heating when running constantly and under full load. These machines are manufactured by the Wenstrom Northern Electric Company, of this city, of which Dr. J. B. De Lery is president; B. Blum, general manager, and B. J. Sturges, secretary and treasurer. This company intend to introduce their system for light and power in the Eastern, Middle, and Western States. The Wenstrom people have already installed during the past year several thousand lights in Baltimore and Annapolis.

THE NORTH AMERICAN MESOZOIC.[1]

IT has become customary upon such occasions as this for the speaker to select a theme from subjects which he is supposed to have specially studied; and I have therefore chosen for mine the mesozoic division of the geological record as it is exhibited on this continent. This theme is so comprehensive that I propose only to select from it certain topics which pertain to the distinguishing characteristics of the principal subdivisions of the mesozoic that have been recognized in different portions of North America; to their interdelimitation and to the delimitation of the division as a whole from the carboniferous system beneath, and the cenozoic above. I shall also make the discussion of these topics the opportunity of expressing certain views which I hold concerning them.

To bring these discussions within the time allotted me they must be confined to three general sections of the mesozoic formations, one of which occurs within each of three regions of the continent, namely, the Atlantic coast, the Pacific coast, and the interior regions. Proceeding upon this plan, let us first consider the general section which is to be observed in the Atlantic coast region.

The rocks which in this region are now generally regarded as of triassic age are found occupying limited isolated districts from Prince Edward Island on the north to the State of South Carolina on the south. If they extend further to the south, or south-westward, they are covered from view by later formations. They are found to rest unconformably upon various formations from the archæan to the carboniferous inclusive; except perhaps in Prince Edward Island, where they are reported as resting conformably, or nearly so, upon reputed Permian strata. Still, no intimate stratigraphical or paleontological connection between the Permian and the trias has been shown to exist there; and the hiatus between them is doubtless as great as it is farther southward, where the unconformity is so conspicuous.

In this latter portion of the region it is evident that the great uplift which involved the paleozoic rocks, including the reputed Permian, took place long before the deposition of the earliest of those triassic beds. These stratigraphical conditions indicate that the hiatus in the geological record between the latest of the carboniferous, and the earliest of the triassic deposits is equal to at least the earlier half of the triassic, as that period is represented in Europe.

The only known paleontological evidence which appears to bear upon this subject agrees with the stratigraphical indications just mentioned. That is, the results of investigations by Professor Newberry upon the fishes and plants of the strata in question, and of Professor Fontaine upon the plants of the same, indicate that they represent the later trias of Europe. But if triassic fishes had not survived to the present day; and if we knew more concerning the developmental stages in the vegetable kingdom from the later paleozoic to the later mesozoic inclusive, a good degree of uncertainty which is naturally felt upon this point would doubtless disappear.

Our knowledge of the land vertebrate fauna which existed at the time these deposits were formed is derived mainly from footprints; and it is therefore more than usually imperfect. The character of this evidence as indicating triassic, rather than earlier Jurassic age, seems to be far from unquestionable.

Very few invertebrate fossils have been found in the trias of the Atlantic coast region; and the few that have been discovered are of little or no value as indicating the age of the strata containing them.

As to the relation of these deposits with the carboniferous system, only stratigraphical evidence has thus far been obtained, and this shows only the bare fact that the former are of considerably later age than the latter. That is, no direct, or even approximately close, biological relationship between them has yet been discovered, the biological hiatus being apparently quite as great as the stratigraphical one. It may be mentioned here also that we have no evidence that the trias of the Atlantic coast was ever continuous, or that it was exactly contemporaneous, with the reputed trias of the interior region, which will be presently referred to.

Intermediate between the triassic beds and the undisputed cretaceous deposits of the Atlantic coast region there is a series of strata, evidently of littoral and estuary origin, but, at least in part, of doubtful age, to which the name of Potomac formation has been applied. These deposits reach at most only a few hundred feet in thickness, and although frequently covered from sight by later formations, they seem to have been originally continuous from New Jersey to the State of Mississippi. They have no known representative west of the Mississippi River, unless it shall be shown that they are represented by some sandy beds at the base of the Texas cretaceous section. These Potomac beds are usually found resting upon the archæan, and at only a few points are they found to rest directly upon the triassic rocks, when they are plainly uncomformable. They seem to be constantly present beneath the marine cretaceous strata just mentioned, and no representative of another formation has yet been observed between them.

Invertebrate fossils are exceedingly rare in the Potomac formation, and the few that have been found give no direct indication of its geological age. Professor Whitfield, however, has suggested that the Raritan clays, together with the Amboy clays, which by some geologists are included in the Potomac formation, but which are probably of later date, are of Jurassic age because of the similarity of his new lamellibranchiate genus *Ambonicardia* with certain European Jurassic shells.

Large collections of fossil plants have been obtained from the deposits here provisionally grouped together under the name of Potomac formation, at numerous and widely separated localities. These collections differ so greatly in character from one another that it seems necessary to infer that more than one flora is represented by them. Many years ago Dr. Tyson found some fossil plants in Maryland which he regarded as of Jurassic age, and which closely resemble certain forms that are found in the European Jura. Professor Ward, in reviewing the large flora which Professor Fontaine has published from the Potomac formation in Virginia, and having in mind also the Maryland plants just referred to, recognizes the Jurassic character of several of the species, according to the European standard, but he takes the rational ground that all obtainable evidence ought to be considered before reaching a final decision as to the true age of the deposits containing them.

Professor Newberry, who has made extensive studies of the plant remains of the Raritan and Amboy clays, finds among them none that give any indication of their Jurassic age. On the contrary, he finds that the flora of those clays as a whole indicates that they ought to be referred to an epoch not later than the middle cretaceous of Europe, nor probably earlier than the upper neocomian.

Professor Marsh has published some dinosaurian remains from apparently the same horizon in the Potomac formation that furnished the plants to Dr. Tyson and Professor Fontaine, which he has referred to the Jurassic.

Paleontological testimony being thus conflicting in its character, one naturally infers that more than one epoch is represented by the deposits that now bear the common name of Potomac formation; but I shall presently call your attention to some cases of commingling of earlier and later molluscan types in one and the same formation which are quite as remarkable as this apparent commingling of diverse plant and vertebrate types in the Potomac formation.

[1] Address before the Section of Geology and Geography of the American Association for the Advancement of Science, at Toronto, Ont., Aug. 29, 1889, by Charles A. White, vice-president of the section.