tralize with sodium carbonate. Add zinc oxide emulsion until sudden stiffening of the solution. Dilute to the mark. Pour in a dry beaker, mix with rod, and pour through a very large ribbed filter into a 250 cc. measuring flask. When the liquid has reached the mark, withdraw, and transfer to a 500 cc. Erlenmeyer flask. Heat to boiling. Add nearly the full amount of permanganate of strength exactly 0.0055, if the percentage of manganese is approximately known. If not add only one and a half cc. permanganate, and boil until the manganese dioxide separates in flakes, and the liquid becomes yellow. Finish the titration shaking after each addition of permanganate till the yellow reappears. The number of cc. permanganate divided by ten will give the percentage of manganese.

Where the method is in daily use, it will be well to use for neutralizing before adding zinc oxide common sal soda instead of the expensive chemically pure carbonate. But this will add about 0.03 per cent. to the manganese, and must be determined and deducted. The sal soda can be procured at grocery or drug stores. Two pounds in two liters of water (and filtered) is a convenient solution.

The impurity is best determined by doing a steel with pure sodium carbonate, then with the sal soda. For convenience, the amount of the soda solution required to nearly neutralize the manganese solution is noted, and that amount is then at once added in subsequent determinations.

AN EARLY AMERICAN ARRANGEMENT OF THE ELEMENTS.

By F. P. Venable.

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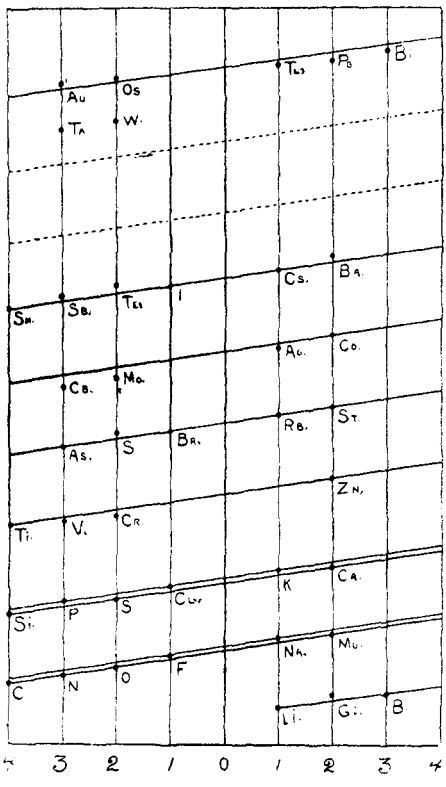
IN going over the papers published during the period immediately following the announcement of the Periodic Law, there is one which possesses especial interest for an American.

It is the "Synoptical Tables of the Elements" by Dr. L. R. Gibbes, of Charleston, appearing in the publications of the Elliott Society in 1875. This table had been prepared some two or three years previously for the use of his classes. In it a professor in a remote and small American college worked out for himself, evidently in ignorance of the arrangements of Mende-

leeff and Meyer, some of the most important principles of the Periodic Law. The evidence of this ignorance is presumptive; first, because his table was very crude and certainly would not have been offered to his classes had the author known of the much superior ones which had already appeared; secondly, he carefully mentions all authorities known to him and upon whom he had drawn in the construction of his table. His library was an antebellum one and the authorities were old. Still he forestalls two or three late authors in his methods of graphic representation of the law.



His table was designed to exhibit:

1. The groups of elements.
2. The atomic weight of each element.
3. The character of each, as perissad or artiad.
4. Their atomic equivalence or atomicity.
5. The electro-chemical character.

In his table the elements were arranged in the order of their atomic weights, but with a good many gaps unfilled, from imperfect knowledge. He remarks upon the "continuity or regularity in the series of numbers" as being very striking.

In his diagram he gives upon the horizontal axes, right and left, from the centre, the positive and negative electricities as abscissas. The atomic weights are laid off as ordinates upon the vertical axes, rising from a zero atomicity. This gives the ele-

ments in an ascending scale of atomic weights, though they are broken up into three series. With much acute reasoning and insight, Gibbes shows that the three series may be exhibited in continuity as one, that is, by the use of an Archimedean Spiral whose radius vector increases by sixteen units in one revolution.

This is the arrangement of Lothar Meyer and de Chancourtois and the spiral suggested by Mendeleeff. His diagram will, on investigation, be seen to be based on the same principles as those of Spring, Reynolds and Crookes.

The author goes further and anticipates some of the geometrical work of Haughton. He observes that no linear equation can be constructed to give more than rude approximations to the atomic weights, and that to construct curves, two points of inflection or contrary curvature must be given. These are the serpentine cubics afterwards worked out by Haughton.

He cautions against laying too much stress upon such arithmetical and geometric exercises.

It seems remarkable that, with so imperfect a table, so much of the later work, done with the perfected tables given by the authors of the Periodic Law, should have been anticipated, especially when we notice how slight was Gibbes' idea of periodicity. He gives in his table seven groups, it is true, four negative and three positive, but they are very poorly filled out, and he shows no completed period of seven in the entire table. His observed regularities can scarcely refer to periodicity, still he makes some mention of what Meyer calls double periodicity, though of course not under this name.

Dr. Gibbes was a professor in the College of Charleston, a fine physicist and a thoughtful chemist. These "Synoptical Tables" which he built up upon the work of Dumas, Gladstone, Cooke, Odling and Barker, speak highly for his insight and power of reasoning.

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