AN IMPROVED METHOD OF OPERATING THE SPRENGEL AIR-PUMP.*

By Professor Ogden N. Rood.

Professor Rood's paper gave an account of his experiments with the pump for the purpose of obtaining the highest possible vacua. He first experimented with an arrangement similar to the ordinary form of the Sprengel pump, and reduced the pressure to one three-millionth. The exhaustion went on very rapidly at first and then very slowly—slower than the increased rarefaction seemed to call for. This indicated a leakage, and it was found that this leakage amounted in one minute to one-eighty-seven millionth of an atmosphere. The form of the pump was modified to correct the leakage, and a vacuum was obtained with a pressure of one-sixty-millionth. It was impossible to get beyond that point, and it occurred to Professor Rood that the potash he used might have given out moisture. He therefore substituted sodium, and the pressure rose only to one-four-millionth. Anhydrous phosphoric acid was substituted for the sodium, and the pressure fell to one-millionth. It finally struck the experimenter that the trouble was in the gauge, and when a correction was applied to the gauge, vacua were obtained with pressures of one ninety-four-millionth and one-hundred-and-ten-millionth. Higher vacua even can be obtained.

It had recently been stated in *Nature*, said Professor Rood, that his arrangement was exhibited four years ago at the Kensington Garden, and he would not, therefore, call it new. But the best result obtained in England was one-twenty-millionth, and the best result reached by an eminent French chemist was one-seventeen-millionth. He, therefore, thought there must be at least something new in his method of using the Sprengel air-pump.

REPORT OF THE COMMISSIONER OF EDUCATION, FOR 1878.

(*Extracts.*)

TEXT-BOOKS AND COURSES OF STUDY.

The lack of uniformity in the conditions of public education in the different States is illustrated in the report on text-books and courses of study.

Returns from 31 States present the following information:

The State board is empowered to decide these matters in California, Connecticut, Delaware, Louisiana, Nevada, and Oregon. In Kansas, Nebraska, New York, and Rhode Island, the State superintendent or commissioner has authority to recommend the text-books to be used, but their adoption and the course of study are finally decided by the school committee or district boards. In Iowa and South Carolina these matters have been decided by a commission appointed for the purpose. In Maine, authority in these matters is delegated to the town supervisor or school committee; in Maryland, to the county commissioners; in Massachusetts, to the school committee; in New Jersey, to school trustees of districts acting with the county superintendents; and in Pennsylvania, to the directors and controllers of each school district, acting with the teachers. District or local boards either solely or acting in concert with superintendents and teachers decide these matters in Michigan, Mississippi, Missouri, Ohio, and Wisconsin.

In the following States—Minnesota, New Hampshire, Tennessee, Texas, Virginia, and West Virginia—the course of study is prescribed by law, but in the application discretion is given to superintendents, local boards, teachers, &c.

In Indiana, North Carolina, and Vermont no definite provision with reference to these matters has been made.

UNIVERSITIES AND COLLEGES.

The total number of universities and colleges reported is 358, with 3,885 instructors and 57,987 pupils. In the preparatory departments of these institutions were 682 instructors and 26,266 students; in the collegiate departments, 3,203 instructors and 30,368 students: unclassified, 1,353. They had 2,187,932 volumes in their libraries, and the value of their buildings, grounds, and apparatus was $36,871,213; their productive funds, $37,071,958; income from these funds, $2,548,324; receipts from tuition, $1,555,484; receipts from State appropriations, $622,577; aggregate amount of scholarship funds, $1,719,426.

Of the students in the preparatory departments, 18,481 are males and 6779 females; 6,576 are preparing for a classical course and 5,621 for a scientific course. In the collegiate departments, 15,803 (14,152 males and 1,651 females) are in classical course, and 3,893 (2,724 males and 1,169 females) are in scientific course.

The summary of college entrance examinations gives the following facts: Total number of candidates, 5,297; admitted without conditions, 2,553; conditioned in Latin, 822; in Greek, 577; in mathematics, 1,068; in history and geography, 585; rejected for deficiency in Latin, 84; in Greek, 70; in mathematics, 66; in history and geography, 22; in two or more subjects of examination, 424.

There are also statements of the numbers preparing for college, classical, and scientific courses, as follows: number preparing for classical course in academies, 6,206; in preparatory schools, 4,195; in universities and colleges, 6,576; preparing for scientific course: in academies, 2,167; in preparatory schools, 1,107; in universities and colleges, 5,621; in preparatory departments of scientific schools, 1,550; total, 27,422.

Students in institutions for superior instruction are distributed thus, viz.: in colleges, 30,368; in schools of science, 11,603; in schools for the superior instruction of women, 18,115; in all 60,086.

The Commissioner presents a brief outline of the movement in colleges to satisfy the demand that the study of science and sociology be advanced to an equality with the classics and mathematics. Without sacrificing anything of the former curriculum, temporary provision for the new studies has been made in most instances by a system of electives. The action is traced through the record of Harvard and Yale Colleges, and the views of Dr. McCosh, president of Princeton College, Dr. Peabody, of Harvard University, and Prof. B. L. Gildersleeve, of Johns Hopkins University, with reference to the most important conditions of the change, are cited.

Some have feared that in this readjustment of college courses the classics would be sacrificed, but the present tendency is toward greater thoroughness and a more extended range in classical studies; nor under the elective system is the number of students who take the modern in place of the classical course sufficiently large to create any apprehension as to the future influence of classical study.

The prevalent views on this subject are well represented in letters from Professor Hæckel of Jena and Professor Zarncke of Leipzig, which are given in full in the report.

SCHOOLS OF SCIENCE.

Of this class 76 schools, including the United States Naval and Military Academies, were reported to the Bureau. They numbered 809 instructors and 13,153 students. The comparative table for the years from 1870 to 1878, inclusive, shows this to be an increase in all particulars over the figures reported for any previous year. The increase above 1877 was in number of schools, 2; instructors, 28; students, 4,594. The number of students in preparatory departments was 1,436, viz.: 1,153 males and 283 females; the number in scientific departments was in regular course, 4,806; in partial course, 772; number of graduate students, 97. The number of volumes in general libraries was 119,164, an increase in the last school year of 3,543; the number in society libraries was 7,737. The value of grounds, buildings, and apparatus reported, was $7,587,421; productive funds, $5,020,446; income from the same, $319,503; receipts from tuition fees, $68,660; from State appropriations, $484,742.

With reference to schools of science the Commissioner observes:

"By the act of 1862 donating public lands to the several States and Territories which should provide colleges for the benefit of agriculture and the mechanic arts, the movement

* Read before the National Academy of Sciences, N. Y., 1880.