cause as formerly. This circumstance, together with the decrease of income from students, owing to the general business depression everywhere prevailing, seriously checked the onward progress of the Institute. President Runkle, by virtue of his occupancy of the executive chair, was called upon during this dark period to bear the chief burden of these reverses. But as will be seen above, not only did he carry the institution safely through this critical period, but also largely increased its educational facilities. He had constantly in mind the development of the school on the basis of the original plan and scope, with the spirit of which he was so thoroughly imbued. The devotion and energy which under such adverse circumstances could establish one new departure for every year of administration should be held in grateful remembrance by all who profit by these increased facilities. Throughout, his watchword seems to have been, "Whatsoever thy hand findeth to do, do it with thy might."

The mining laboratory was conceived and planned by President Runkle. With a view to making the students of the Institute acquainted with those who might be their future employers, and thus opening up a channel of communication for mutual benefit, he organized expeditions of students and professors, in the face of great difficulties, and visited Colorado and other mining regions of the West in two successive summer vacations. As a result of this undertaking, he conceived the idea of a practical mining laboratory, which he immediately put into execution.

The establishment of the School of Mechanic Arts is also due entirely to the exertions of President Runkle. In a visit to the Centennial Exposition, held in Philadelphia in 1876, his attention was attracted by the unique exhibit of the Russian schools at Moscow. He was quick to perceive the practical value of this method of teaching, consisting of instruction in the use of tools, as distinguished from the art of construction. The Russian commissioners, observing his appreciation, presented him with the greater part of their exhibit; and, aided by this, he at once prepared plans for the erection of a building in connection with the Institute for the purpose of teaching this system. These plans were speedily executed, and a report prepared two years later was sent to Russia, and resulted in the presentation to the Institute of a still more complete set of models, by the command of the Czar.

The incessant strain both of mind and body caused by these untiring efforts for the support of the institution, whose interests he had made so entirely his own, compelled him to resign in 1878, and take a well-earned rest by a two-years' visit to Europe. Even then, always mindful of the cause of technical education, he made a valuable and thorough examination of the Continental schools whose specialty is instruction of that nature. The result of these observations he embodied in a paper read before the Society of Arts shortly after his return, a full report of which was published in the New England Manufacturer for April 15, 1881.

In 1880 he returned to the Institute, to resume his duties as professor of mathematics.

The Steam-Engine Indicator, and what it indicates.

II.

The following diagrams have been taken this school year by members of the Senior Class in Mechanical Engineering; and as each diagram has some special feature, we hope the explanation will prove interesting.

The diagrams shown in Fig. 1 were taken at the same instant from both ends of the cylinder. The diagram on the left shows a very bad adjustment of the steam valve,—a defect which the indicator alone can show, as the engine to all outward appearance was running perfectly. The admission valve does not open until the piston has started on its stroke, hence we have the curved steam line E C A. From the point of cut-off A we have a fair card up to the point E on the return stroke.