

Electricity of high tension means something evoked by an electrical machine. These pieces of apparatus which I have mentioned form a salient point of attack upon the system of instruction in physics too common in many schools. A good air-pump is difficult to keep in order, and finds its true place only in the private laboratory of an investigator, or in a college collection of apparatus. In the secondary grade of schools some form of Sprengel's pump, or, where there is an available head of water, an aspirator, will illustrate varying pressures sufficiently well. The new Holtz machine which schools are anxious to possess can only serve as a toy, for the theory of its working is very hard to comprehend even by those who have studied the subject in mature years.

The modern view of the physical universe is that there is no such state as rest: the particles of a gas are in an incessant state of motion, and it can be maintained that when a stone rests upon a table it is not at rest; for it is forced downward by the action of gravitation through a very small distance, and the elasticity of its support tends to move it upward through the same distance. The term statics is apt to be misleading, and the best writers on science of to-day begin treatises on natural philosophy with the subject of dynamics or forces in motion. In no subject, however, is the division into statics and dynamics so illogical as in the subject of electricity. In most schools a student begins the study of this subject with frictional electricity and the electrical machine. An advanced student in a university pursues the opposite plan, and approaches the subject, even if it be for the first time, from the standpoint of the voltaic cell, and traces the development of the force up to the point of the generation of electricity similar to that produced by an electrical machine. Very little knowledge

can be obtained from the exhibition of toys like dancing pith-balls, insulated stools, miser's plates, and apparatus for obtaining shocks.

The method of instruction in physical science, therefore, in the secondary grades of schools, seems to me to be too costly and not sufficiently logical. The remedy does not consist in curtailing the amount of attention paid to the subject in the lower schools, or in relegating it to a more advanced period of education. It is more reasonably embraced in leading teachers to seek simpler methods of instruction, simpler apparatus, and to avoid abstruse conceptions, and the solution of mechanical problems for which mere formulas are given. It would be well, also, if the best students are led to experiment themselves, and are stimulated to observe. This is hardly possible in crowded grammar schools; but the excellent little treatises of Professor Mayer on experimental physics would lead many children, under proper encouragement from their teachers, to try simple experiments at home.

An ideal method of teaching physics in the secondary grade of schools would consist in developing the whole subject from the standpoint of motion, insisting upon the larger facts, correlating them as far as possible, and neglecting special applications and special facts. A number of interesting experiments can show that work must be done in all cases to produce work, and that motion can be changed into heat, and heat into motion. The student's mind should be tempted to take, at the very beginning of his study of the subject, an extended view of the application of the law of the conservation of energy. While treating the subject of force, a little descriptive astronomy can be given which will aid in stimulating the imagination. The subjects of heat and acoustics can be taught purely under the head of mechanics, with a variety of most inter-