twine, to illustrate the accuracy of the work. One of the most interesting exhibits of the school is the Willis apparatus for illustrating the principles of mechanism, with accounts of experiments made by students. In the case of a jack screw, it was found that the efficiency was but 23 per cent of the power applied, 77 per cent being required to overcome friction. With a crane, the efficiency was 67 per cent, and with a differential pulley, less than 32 per cent. The advantage of deriving a knowledge of simple machines from experiment rather than from a theoretical investigation, in which the enormous losses that occur in practice are ignored, is obvious.

THE STEVENS INSTITUTE OF TECHNOLOGY.

The visitor will find this exhibit near post T, 67, in the Main Building. It may be a matter of regret to some that so much of the display is devoted to the apparatus of the Institute and the work of its professors, and so little to what has been accomplished by the students, while the want of a catalogue or any method of gaining information will be seriously felt by the casual visitor. The exhibit is, however, of great interest, including a fine collection of the physical and mechanical apparatus of the school, much of which is unequaled, together with accounts of the results obtained by, and illustrations of the apparatus used in, the experiments of Professor Morton on fluorescence, of Professor Mayer on sound, and of Professor Thurston on the strength of materials. There are a few drawings by students which are exceptionally fine, but they are hung rather too high to allow of a close investigation. The engineer will doubtless be much interested in the elegant drawing of the governor invented by Professor Thurston, and equally so in the illustration of Professor MacCord's theodontoscope, for testing the accuracy with which the teeth of gear wheels are cut, by observing the velocity ratio of two teeth at different points of contact. The reader of the SCIENTIFIC AMERICAN SUPPLEMENT does not need to be assured that the Professor of Drawing at the Stevens Institute is one of the ablest instructors in the country; but it is questionable whether this school would not have done well to have made a more general exhibit of the drawings executed in ordinary course by the students.

The practical work of the senior class is illustrated by one of Professor Thurston's well known testing machines. By disregarding the printed request, and touching this exhibit, it will be observed that the construction is not as accurate as in some of the machines described above. The specialty of the Stevens Institute of Technology is thorough instruction in mechanical engineering. The course covers a period of 4 years, the school year consisting of about 35 weeks. The annual expenses are about $500, the tuition fee being $150 per year.

ILLINOIS INDUSTRIAL UNIVERSITY.

The display made by this institution will be found in the south gallery of the main building, among the educational exhibits of the State of Illinois. It consists of apparatus used in the school, models made by the students, records of some of their experiments in physics and the strength of materials, and drawings. One of the models, a flight of elliptical stairs, is an exceedingly creditable production. The specimens of machine work, being enclosed in a glass case, could not be examined very critically; but they do not appear to be as well finished as those exhibited by some of the other technical schools.

The Illinois university offers courses of instruction in agriculture, engineering, natural science, literature and science, military science, commerce, and domestic science and art, open to students of both sexes. In this instruction, practice plays an important part, and there is a machine shop in which articles are manufactured for the market. The catalogue of the university, which was given to visitors, was printed at the institution. It is perhaps only fair to say that this is not, in all respects, a first class piece of work. The complete course in any department requires 4 years, of 36 weeks each, and the annual expenses vary from $150 to $300, principally for living expenses, the tuition fees being merely nominal.

UNIVERSITY OF PENNSYLVANIA.

One of the alcoves in the Pennsylvania educational building is devoted to the display made by this university, which consists of drawings, text books, models, apparatus, and some examples of bridge trusses and gearing made by the students. It is not intended as a representative exhibit, visitors who are interested in the matter being referred to the university, which is located in Philadelphia, for further information. This university bids fair to become one of the most prominent technical schools in the country, being richly endowed, having spacious buildings, and an unusually fine collection of apparatus. One of the most important courses, that of mechanical engineering, has not yet been established, but it is probable that it will eventually form a very prominent department.

The above is a brief description of the exhibits of some of the more prominent technical schools of the United States. It will be observed that many well known schools are missing from the list; and it is a matter of regret that a full representation could not have been secured. The list might have been considerably extended by reference to the instruction in drawing and engineering, as illustrated in some of the general educational exhibits, but the limits of this letter will not permit such a wide range. The exhibits of foreign technical schools may form the subject of a future communication.

R. H. B.

Philadelphia, Pa.

Brown, Purple, Green, and Yellow Ultramarine.

A Frenchman named Guimet has patented a new process for making ultramarine of these various colors. By the substitution of selenium for the sulphur in blue ultramarine, he obtains a brown and purple ultramarine. If in a similar manner tellurium be substituted for the sulphur, he obtains a green and yellow ultramarine.

Green and violet ultramarine are not new, having been in the market for some time. The method of manufacture has been kept a secret, and it is only through the careful analyses of Dollfus and Mieg that we have an insight into their composition. They analyzed three kinds, with the following results:

	Green.	Blue.	Violet.
Silica	37·770	37·860	22·305
Alumina	31·499	24·285	12·790
Oxide of iron	0·181	0·180	0·420
Soda	13·401	12·009	6·855
Potassa	0·480	0·000	0·000
Sulphuric acid	0·693	1·104	1·004
Sulphurous acid	0·405	0·780	0·764
Hyposulphurous acid	0·000	0·621	1·742
Sulphide of sodium	8·592	6·582	1·255
Free sulphur	3·310	7·929	3·188
Gypsum	trace	trace	41·814
Water	4·884	4·904	11·537
Kaolin	0·526	3·039	4·546

It is evident that the violet was adulterated with plaster of Paris. Although there is much similarity in their chemical composition, their structure must be quite unlike, as evinced by their action towards reagents. All three are decomposed by dilute acids, with an evolution of sulphuretted hydrogen and separation of sulphur. This reaction is slowest and weakest with the violet. When green ultramarine is decomposed with hydrochloric acid, great heat is evolved. Concentrated acetic acid, which does not attack lapis lazuli, does not attack blue ultramarine, but evolves gas from the violet and green. Oxalic acid slowly destroys the color of the green and blue, but rapidly decomposes the violet, with an evolution of sulphuretted hydrogen at first, then of sulphurous acid. A boiling solution of alum does not attack the violet, but readily attacks the green and blue. Ammonia, caustic soda, and potassa do not act upon the green and blue, but turn the violet blue. Fused nitrate of silver attacks all sorts and makes them white. Bromine dissolved in hydrochloric acid decolorizes them all. Concentrated nitric acid decolorizes all, with evolution of red fumes.

At a moderate temperature the violet changes to blue, and at a greater heat it turns white or pearl grey. Green resists the action of heat better than violet, but after a time it takes on a bluish green color, and at a very high temperature turns white. When heated with arsenious acid, the green remains unchanged, but the blue turns green, and sulphide of arsenic sublimes. Heating with zinc dust decolorizes all kinds of ultramarine.

Stevens Institute of Technology.---Commencement Exercises.

The second annual commencement of the Stevens Institute of Technology, N. J., took place on the evening of June 30. After a short and appropriate prayer by the Rev. S. B. Dod, President Henry Morton spoke substantially as follows: "The occasion which brings us together this evening is memorable in many respects. The present graduating class of 1876 commences its independent life at a time which coincides with the great celebration of the completion of the first century of our nation's existence. Two trains of thought are suggested by this coincidence. First, that much of our material prosperity is owing to the mechanical genius of our people, who, by the aid of labor-saving machines, have been able, at so early a period, to surround themselves with the comforts and elegances of life. This progress is due, directly or indirectly, to the mechanical engineers. Secondly, that our nation is no longer in its crude and vigorous youth, but needs men thoroughly trained and educated, if it is to keep up in the race of progress with the other nations. It is to 'Stevens '76' and such as them that we must look to make our next century as prosperous as the past. Finally, let us all, faculty, *alumni*, graduates, and students, adopt the sentiment uttered by one of that great class of '76 in Philadelphia, a hundred years ago: 'Let us all hang together,' although we are not, as they were, exposed to the danger of all "hanging separately" in case we fail."

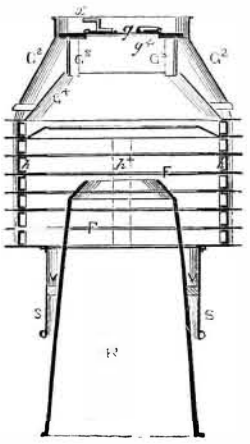
In the next place, the salutatory address was delivered by Edward B. Wall of the graduating class. Then followed abstracts of the theses: "Project for Erection of Two Blast Furnaces," by William Kent; "Transmission of Power by Wire Ropes," by Albert W. Stahl; "Manufacture of Illuminating Gas," by Alfred P. Trautwein; and "Theory of Windmills," by Alfred R. Wolff. These theses evinced considerable original work and research, the students having devoted several months to their preparation, during which they visited shops and factories, made experiments, and executed elaborate drawings. President Morton then introduced Mr. Reuleaux, Director of the Berlin Polytechnic Institute, and President of the German jurors of the mechanical section of the Centennial Exposition, as the representative of a sister institution.

Mr. Reuleaux spoke a few words in very good English, in which he begged permission to use his own language, the German. He spoke as follows: "In addressing you as the representative of an elder sister, as your President has kindly styled our Institute, I would have it understood that I do not feel as though I could claim any other advantages than those of age, but am proud to greet you as an equal. Our aims are essentially the same, to combine thorough practical instruction with the advancement of true science. The steam engine, which is the type of our profession, is not a mere mechanical contrivance, but the expression of an intellectual conception. It is, as it were, an enlargement of man's powers over nature, a continuation of his faculties. Its study, therefore, when conducted in the proper spirit, is an ennobling one, and deserves to go hand in hand with science for the amelioration of human society. I have visited this institution, and am rejoiced to see that its professors are imbued with a sense of their high vocation, which cannot fail to produce the happiest results. The scientific researches, moreover, which are here made, rank with the best that have ever been made anywhere." Mr. Reuleaux concluded with a few words of good wishes to the graduates and exhorted them to maintain the dignity of their profession. His speech, though in German, was well appreciated and elicited hearty applause. Mr. Dod, President of the Board of Trustees, then conferred upon the class the degree of Mechanical Engineer, and the exercises concluded with an impressive valedictory address by J. Mather Wallis.

The theses not already mentioned were on the following subjects: "Centrifugal Pumps," Samuel B. Brewer; "Designs for an Overhead Traversing Crane," John O. Buerk; "Pumping Engines," James M. Cremer; "Suspension Cables of Brooklyn Bridge," Gustavus C. Henning; Design for a Paper Mill," Joseph Kingsland; "Design for Iron Foundery," Philip E. Raqué; "Screw Propellers, Principles and Practice," Adam Riesenberger; "Apparatus for Extinguishing Fires," Eugene L. Vail; "Principles of Car Framing," Edward B. Wall; "The American Beam Engine," J. M. Wallis; "Construction of the Steam Hammer," Edward L. Wells; "Design for a Steam Dredge," William F. Zimmermann.

IMPROVED CHIMNEY COWL.

An automatic cowl for correcting smoky chimneys and ventilating buildings has been applied successfully to some public buildings in London. The action is continuous, and there is no mechanism to get out of order. The engraving shows a vertical section of the cowl. R is a truncated portion of tube which may be attached to the chimney pot. S is also a similar portion placed over the truncated tube, R.



The tubes or cones, R and S, are kept apart from each other by means of distance pieces, V. At the top of the tube, S, are placed a number of annular rings, superimposed, or perforated plates, F, separated from each other by means of distance pieces or blocks, *h*. Bands of metal —*h**, help to hold together the plates. These plates, F, are surmounted by a cap designed to prevent down drafts, which is constructed as follows: G* is a truncated conical cap, provided with upright supports, g^3, on the top of which is a flange or ring, g^*, so as to support a dome or door, G. Another conical cap or casing, G^2, is placed round the cap, G*, and rises above the flap or door, *g*. The outer conical casing, G^2, is secured to the uppermost of the plates, F, by distance pieces or nuts. A free passage for the air is left between the inner and outer casings. Sometimes the door or dome is a fixture, but, when movable, a bent piece of metal, X, acting as a spring, closes it, after the brush or instrument used for cleaning or sweeping the chimney has been withdrawn. This dome or door, besides preventing down drafts, also prevents rain, snow, or other matters entering the chimney. The action of the ventilator is claimed to be that the constant movement of the atmosphere, passing transversely between the plates, F, withdraws all smoke, gas, and vitiated or noxious vapors.—*Building News.*

Centenarian Birds.

It may not be generally known, says the *Wexford Independent*, that the eagle, raven, and parrot are each centenarians. An eagle kept in Vienna died after a confinement of 114 years; and in an ancient oak still known as the raven tree, the same pair of ravens are believed to have fixed their residence for a series of more than 90 years. Swans upon the river Thames, about whose age there can be no mistake —since they are annually marked by the Vintner's Company, under whose keeping they have been for five centuries— have been known to survive 150 years and more. The melody of the dying swan is mythological. Upon approach of death the bird quits the water, sits down upon the bank, lays its head upon the ground, expands its wings a trifle, and expires, uttering no sound.

Corn Cobs.

One of our city exchanges, says the Ohio *Farmer*, objects to using corn cobs for fuel. They are too valuable. He recommends covering them with a plaster of oil, meal, bran, etc., and feeding to cows. The plan is fully equal to that suggested by a correspondent of another paper, to keep shade trees out of pastures to prevent cows from getting lazy. One cheats the poor brutes into eating that which is unnutricious and unpalatable, and the other forces them to eat by depriving them of shelter from the hot sun; at least, that is the intention.