magnifies my political importance in my country, and does me too much honor in calling me a proscribed exile. It is true that I served in the Polish insurrection of 1863, that I passed nineteen or twenty months in Prussian prisons, and that I was the editor of a political newspaper in Cracow; but I never was exiled, not having had either opportunity or ability to distinguish myself so much as to receive such a flattering mark of esteem from the Russian government, which is the only one in which the penalty of exile still exists. There are thousands of my countrymen who have done and suffered so much more for the national cause, that I deem it unworthy of me to assume or accept undeserved titles to the public sympathy and admiration.

At last, may I be allowed to add, in regard to some remarks of the writer about my native land, that although Poland has passed through many more or less fortunate wars, it never was subjugated before 1772, the fatal year when the crime of its first partition was accomplished; also, that the populations of Cracow and Warsaw, far from being mixed, are thoroughly and essentially Polish, as well from origin as in heart.

Yours,

C. Bozenta Chlapowski.

HOME AND SOCIETY.

The Boys of the Family.—III.

HOW TO BECOME A MECHANICAL ENGINEER.

While the aspirant in the field of mechanical engineering may acquire a satisfactory education at the Massachusetts Institute of Technology, at Cornell University, at the Sheffield Scientific School connected with Yale, at the Rensselaer Polytechnical School of Troy, and at several colleges, including Harvard and the University of Michigan, which make a feature of instruction in technology, none other offers him the same facilities as the Stevens Institute of Hoboken, New Jersey, which, though its curriculum may lead to the degree of Bachelor of Science or Doctor of Philosophy, concentrates most of its forces on this one specialty. The institute was founded in 1867 by the endowment of the celebrated engineer, Edwin A. Stevens; it is pleasantly situated in Hoboken, about one hour's distance from the central part of New York City, and its faculty includes many eminent men, including Henry Morton, the president; Robert H. Thurston, the professor of mechanical engineering, and Alfred M. Mayer, the professor of physics. The collection of apparatus is undoubtedly the most complete in the country, and comprises, besides full sets of those embodying late improvements, the identical instruments used by the most famous discoverers in science,—notably those of Dalton, Gay-Lussac, Dumas, and Regnault. The cabinet of optical instruments has been declared to contain more riches than all the cabinets of France, and, perhaps, of Europe combined, and in the engineering department the collection includes, besides a variety of modern machinery, some invaluable relics, such as the high-pressure condensing engine, tubular boiler and screw, which, early in the century, drove the first steamer built by John Stevens, eight miles an hour up the Hudson. While availing himself of instruments of exquisite adjustment and perfect finish which facilitate his work in a manner unknown to his predecessors, the student can trace the successive developments by the actual object (much more memorable than a printed description), and find a stimulus to ambition in repeating the experiments made by Faraday or others with the very apparatus that the great physicists themselves employed. Other things being equal, the equipment of its physical and mechanical laboratories would still give the Stevens Institute an advantage over other schools in preparing young men for the profession of a mechanical engineer.

The boy who has a positive talent in this direction is apt to reveal it at a tender age. Like the *cacoëthes scribendi*, which plunges its immature victim into such trifling literary matters as epics and tragedies without compelling a knowledge of orthography or prosody, the mechanical instinct is urgent and overflowing, and applies itself to practice at a very early period. It has been known to separate all the parts of a watch which has been incautiously left within the reach of a seven-year-old—to separate them so perfectly that they could never be put together again; and another manifestation familiar in many large families, has been the unaccountable removal of all the door-knobs, or the suddenly eccentric conduct of an old kitchen clock which has hitherto been unimpeachably regular in its habits. That there are apparently no tools or materials for this instinct to work upon is not an embargo. Its demands upon the domestic pharmacopœia are its most reprehensible feature; it is extravagant in requisitions for court-plaster, witch-hazel and bandages. Gradually developing from a diffusive and barren propensity to tinker, it has achieved three definite results in a case known to the writer, when its possessor was only thirteen years old—a model locomotive that "went" spasmodically, a model marine engine that would not "go" at all, and a model air-pump that inauspiciously burst. But has not the road to success always been paved by such failures?—not failures at all in the eyes of the young mechanician, but exciting and anticipated culminations.

The mother may be happy and content, despite her anxiety over his cut and crushed fingers, if her boy evinces such inclinations for mechanical pursuits; he is surely not idle nor stupid, and they open to him all the possibilities of a growing, permanent and lucrative profession.

For such a boy there is no better preparation than the course of the Stevens Institute, candidates for admission to which are examined about the end of September. They must not be younger than sixteen, and must be well grounded in all English branches, especially in the properties of numbers, the operations in common and decimal fractions, the methods of finding the greatest common divisor and the extraction of the roots of numbers. In algebra the requirements include simple equations, equations of the second degree and radicals of the second degree; in geometry, all of plane geometry (and not only must the facts be completely memorized but a logical process of reasoning must be shown); in trigonometry, the definitions, the trigonometrical solutions of right-angled plane triangles, and the solution of oblique-angled triangles; in English grammar, an exact knowledge of principles deduced from copious examples; in geography, a knowledge of the countries, waters, etc., most frequently referred to in the daily newspapers; in composition, an essay upon a subject given at the time of the examination, embodying legible hand-writing, correct spelling, punctuation and syntax; and in universal history such a knowledge as will furnish a basis for subsequent instruction in literature and the philosophy of history. The course of instruction lasts four years.

In the department of mathematics and mechanics, the studies are, in the first year, elementary mechanics and review and conclusion of geometry, trigonometry and algebra; in the second year, analytical geometry, differential and integral calculus; in the third year, analytical mechanics, the resistance of materials and the theory of bridge-building, and in the fourth year the theory of bridges and roofs and graphic statics. In the department of belles-lettres they are (first year) rhetoric; second year, the historical elements and developments of the English language,—its phonetic elements and logical forms; third year, English literature, and fourth year, Guizot's "History of Civilization in Europe." Chemistry is taught in the second and third years of the course, and in the fourth year to advanced students, according to special arrangements.

In the department of physics, the first year is devoted to the inductive method of research,—inductive mechanics, the properties of matter, pneumatics, heat, the laws of vibratory motions and acoustics; the second year, to the study of the applications of the laws of heat to the action of heat-engines and meteorology, light, magnetism and electricity; the third year to the explanation of the construction, methods of adjustment and manner of using instruments in precise measurements, and the fourth year to work in the laboratory. In the department of physics, the first object is to give thorough instruction by lectures and recitations with illustrations, followed by practical experiments in the laboratory; and the second to advance the knowledge of physics by original researches conducted by the professor of the department. The method adopted is of great service to the student inasmuch as all his interest is awakened as he verifies and extends by practical observation the facts acquired from the lectures and text-books. The instruction in drawing extends throughout the whole course.

In the department of engineering two years are devoted to the study of mechanical science and the materials of construction. The student becomes familiar with the construction of typical machines, and the form as well as the theory of prime movers. He spends two days a week in the workshop, and there learns the construction, use and manipulation of machine tools,—the mechanic's "knack,"—and he observes work in progress under the hands of experienced men. He visits the foundry, where the molder is busy, and he soon learns the technic of that business; pattern-making and other occupations are seen in practice. In brief, it is intended that though he may not leave the institute a completely equipped workman, he shall be prepared to become one in a short time. In the mechanical laboratory, he uses the apparatus of the engineer and learns the forms of machines for determining the tensile, tensional and transverse strength of materials, the steam-engine, indicator, etc.; he takes part in tests of all kinds of materials of construction, and in using the dynometer, the pyrometer and other instruments. "The exceptionably complete outfit of this laboratory," Professor Thurston has said, "and the wide range obtained by it in doing its work, as a matter of business for all kinds of business men, gave opportunities which, confident as I was of its ultimate success, I did not imagine when I undertook its organization. These advantages are obtained, and the laboratory pays its own expenses."

In estimating the student's capabilities, the highest value is attributed to proficiency in engineering; mechanical drawing stands second, physics third, and French and German fourth. The course is exacting, and not more than one half-the candidates admitted are finally graduated. It is safe to say, however, that the boy whose inventive exploits we have mentioned above, succeeds by the persistence and earnestness of application that make success almost inevitable in any walk of life.

The fees for the entire course are two hundred and twenty-five dollars, except to students resident in New Jersey, who are charged one hundred and fifty dollars, according to a clause in the will of the founder. This sum includes instruction and the use of instruments, but the cost of any damage done may be deducted from a deposit of ten dollars, made when the student enters. Four scholarships, conferring the privilege of attending the course gratuitously, are given annually,—one to the graduate of the Stevens High School who passes the best examination at the end of the spring term, and three to the most successful graduates of the Hoboken public schools. The High School, also endowed by Mr. Stevens, is practically a department of the Institute for academic instruction, and its relations with the latter give it peculiar advantages in scientific studies. The fees for tuition are one hundred and fifty dollars a year, inclusive of all extras.

Richly as the Institute is endowed, it offers only one prize, a sum of twenty-five dollars annually, for proficiency in chemistry, and it makes no provision for boarding its students, except in keeping a list of desirable houses for their consultation. The catalogue mentions eight dollars a week as being about the average cost of board, but it is not easy to be specific in writing upon this matter without misleading, as much depends on the resources of a student and his previous habits of life. It appears to us that eight dollars may be said to be the maximum, rather than the average. For that sum he should be able to obtain a well-furnished single room and a liberal table, while numerous comfortable boarding-houses are open to him at six or seven dollars, and others at a still smaller sum. If his means are small, he may be able to find accommodations for five dollars a week, and by clubbing with other students in circumstances similar to his own—perhaps renting one of the small cottage houses that abound in Hoboken, furnishing it frugally and catering personally (a somewhat dubious but an interesting experiment), he may teach the world undreamed-of domestic economies.

A graduate is not likely to wait long for employment at any time, and in a favorable season he is pretty sure to find an opening as soon as he leaves the Institute. His salary as a beginner may not be large, but it will probably be sufficient to support him. The profession is not overcrowded; it is dignified and lucrative; and in an age of iron and steam, of wonderful engineering accomplishments and potentialities, an alumnus of the Institute need never despair of securing an ample livelihood, and obtaining a good position in society as he matures. Of the students recently graduated, one is now engaged in a steam-heating and ventilating establishment; another has a position on the Michigan Southern Railway; another is employed as instructor in the Institute; another as a consulting engineer; another in the Midvale Steel Works; another as assistant-editor of a technical publication; another in the Franklin Paper Mills; another in the engineer corps of the United States navy; another in the car-shops of the Pennsylvania Railway; another in a manufactory of brick machinery; another as professor of engineering at Yeddo, Japan; another as a patent lawyer; another at ship-building works in St. Petersburg, Russia, and another on a survey and exploration of the western territories. These, in brief, indicate the variety of positions to which a graduate is eligible.

William H. Rideing.

Note.—The Maternity Society.

In the December number of this magazine, mention was made of the Maternity Society of the Church of the Transfiguration of this city, and some explanation was given of the aims and motives of this most worthy organization. The third annual report of the society has recently been issued, and in it the secretary, referring to the notice of the association in these pages, says: "We are indebted to Scribner's for making our work known in different parts of the country: letters have been received from western and northern cities, and from Manchester, asking for more information on the subject that similar societies might be established on our plan." In all cases this information has been cheerfully given; and any one who may desire to have further knowledge of the workings of this novel, useful and self-respecting charity, or who may be glad to read the annual report giving particulars of its work, has but to apply to the Secretary of the Maternity Society, Church of the Transfiguration, No. 1 East 29th street, New York.

A Design for a Fire-place.

An English gentleman, who seems not to be aware of the extent to which fire-places are in use in this country, sends us the following description of a fire-place (shown in the cut), for which he claims unusual advantages. The use of fire-brick in making ornamental tiles is, we believe, entirely new. He says:

I see by your pages that the open fire, which is all but universal in Britain, is strongly recommended for adoption in the States. It is of some importance that a good form or pattern of fire-place should be introduced, otherwise the experience may be so unsatisfactory as to prejudice the users against open fires altogether. There is no question that many fire-places in England are as ill adapted for their purpose as fire-places can be, and that many of them afford the minimum of heat for a given expenditure of coal. I venture to send you a drawing and description of a fire-place, which is, in my experience, unsurpassed for radiation of heat and perfect combustion of coal, and which has also proved itself a remedy for a smoky chimney.

The first thing to note is that there as little iron as possible is made use of. There is a bottom grate and front bars only; the combination is here called "Leamington bars"; but there are two points to be studiously attended to in these; first, the front bars must be beveled inward on the opposite side; second, the bottom grate must be set below the level of the lowest bar from a half to three-quarters of an inch. Unless these points be observed the coal will fall out and litter the hearth, and the action of the grate be imperfect.

The next thing to note is that the jambs or cheeks of the fire-place are set at an angle of 45° from the wall face, so as to form a right angle where they meet. Thus, if the width of the opening be three feet, the depth of the triangle will be eighteen inches. The depth may be increased a little without much detriment, but if it be diminished so as to make the angle at the apex greater than 90°, the fire will lose its power, in proportion to the increase of the angle. These jambs may be built of fire-brick, but for appearance I have had blocks made to form the side and back of the fire-chamber, and tiles $6 \times 6 \times 2$, of glazed fire-clay (salt glazed) for the jambs; and again, for superior work, painted or majolica tiles are used at the front part of the jambs. All these details are shown on the drawing, but I draw attention to them in order to indicate what is essential and what merely accidental.