ORE EXTRACTION

By PROF. CHARLES E. LOCKE.

In another article mining engineering has been discussed in the broad sense and it remains here to discuss it in the restricted sense, namely as covering only the extraction of the various ores from the ground. This course runs throughout the junior year and instruction is given entirely by lectures. The practical acquaintance with the subject may be obtained in summer school or by work in mines during vacations.

As an introduction to the course a few lectures are devoted to mechanism and machine parts so that the student may listen understandingly to descriptions of mining machinery later on. Likewise a few typical ore deposits of the United States are described so that a man may have in mind the conditions which govern the use of different methods in different places.

Next under prospecting are covered the indications of ores and the tools used in rotary drilling (diamond drill) and in percussion drilling for determining the character of the ground to depths of even 4,000 or 5,000 feet.

Under tools for breaking ground are hand tools, rock drills, compressors, coal cutters and explosives. Methods or drilling and blasting are discussed.

Under the supporting of excavations are covered life and preservation of timber, masonry, cement, framing of timber, excavation by use of shields and shaft sinking by special processes in quicksand and other soft running ground.

Forms of mine workings are very numerous, depending on the ore deposit. Typical examples are given of quarries, open pits, shaft and level system for metal mines, and coal mines of both the bituminous and anthracite variety; also special methods for large ore bodies like the iron mines of Lake Superior and the operation of washing auriferous gravel, both by the use of hydraulic jet of water and by the use of dredges.

Haulage includes cars, rails, man tramming, the use of horses and mules, steam, electric and compressed air locomotives, wire rope cable, arrangement of tracks and aerial tramways.

Hoisting is effected by hand windlass, by horse and by hoisting engines which may be run by steam, compressed air, gasolene, water wheel or electric motor. Numerous types are described and attention is given to the parts such as drums, brakes, clutches, indicators, etc.; also to hoisting ropes, buckets, cages, skips, head frames and plant at the mouth of the shaft.

Under drainnage and pumping come dams, drainage tunnels, hoisting water in tanks, and pumps of all kinds, including Cornish rod pumps, direct pumps, centrifugal pumps, rotary pumps, etc.

Ventilation includes a consideration of mine gases, and apparatus for supplying fresh air to the miner. Closely allied to ventilation is the suoject of explosions, their cause and prevention and the same for mine fires.

There are numerous other subjects which are included under mining. These are the lighting of mines; the methods used for ingress and egress of the miners; mining laws which govern the acquiring, holding and operation of metal mines, coal mines, tunnel sites, mill sites, water rights and placer ground; the handling of workmen and provisions for their comfort and improvement; accidents in mines their cause and prevention; the examination of mines to determine their value; underground surveying; the keeping of accounts and the making of reports.

From the foregoing it will be seen that the ground covered makes the course of necessity a descriptive one and there is little time for problems or for a detailed study of many of the operations. An advanced course in mining is offered to students who wish to go further into details and also spend some time in working out problems in connection with a mine plant.

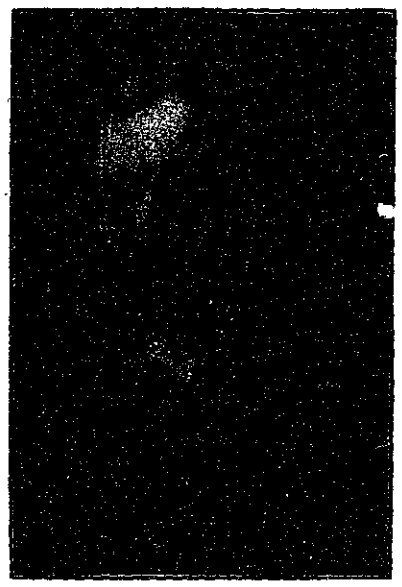
TEACHING OF MINING

By PROF. H. O. HOFMAN.

The question is often asked by students in the Department of Mining and Metallurgy if it is not advisable to go to one of the old-established mining academies or to the new technological institutes of Germany which give courses in mining and metallurgy, and follow there some general or advanced course and thus round out the technical education received here at the Institute. The present issue of The Tech forms a good occasion to bring this matter before the students of Course III.

The Institute receives its students from high schools and aims to give them a general, as well as a technical education; in fact, two of four years assigned to a course are taken up with general and auxiliary studies, leaving only two full years for really professional work, and some part of this time is devoted to studies that are not strictly professional. It is evident that the professional time cannot be so extended as is the case with the four years of a German technological school, in which no general studies whatever enter the programme. In fact the German has finished his general education in the gymnasium, comparable in quality to the Latin high school, or the Realschule, similarly comparable to the English high school, before he enters upon his technical studies; the German technical school, as well as the university, is a post-graduate institution. The graduate of a German Realschule is through with English and French, he reads these languages with comparative ease and writes and speaks them somewhat; he is familar with the political history and geography of the world, in mathematics he has included differential calculus, he has had his courses in general physics and chemistry and has gone far enough in qualitative analysis to begin with quantitative. In fact, as far as his positive acquirements go he is in line with the average college graduates. The consequence is that the technical school can begin where the realschule stops.

The aforesaid would lead one to believe that starting with such well-prepared students, the courses of technical instruction in Germany would be on a much higher plane than are ours, and our graduate could not do better than go from the Institute straight to Germany and obtain there that advanced training which would prepare him so much better for his professional career than his colleague who staid at home and went straight to work. It is true that many technical courses given on the other side are of a more advanced grade than those given with us, if by advanced we mean theoretical; others, however, and most of them dealing wit' mining and metallurgy, simply cover the field in a larger way; the subjects are developed historically and much time is devoted to this side, but the time given to modern methods is not greater than is the case here. The German thus gains an historical perspective for which we have not the time. When, therefore, the essentials as to the present and future practice in mining and metallurgy are concerned, the German student stands about on the same footing as the one at Technology, only the German has a larger background and perhaps therefore a firmer foundation. There is, however, another side. German instruction in mining and metallurgy is exclusively by lecture, the laboratory is practically non-existent. The German professor develops his subject systematically in his lectures, the student absorbs what he can, and studies the rest from the numerous treatises that have been published. When the lecture is finished the responsibility of the professor ceases. It is the student's duty to study these lectures and acquire knowledge as best he can by himself. It is easily recognized that courses on mining, ore dressing and metallurgy without the accompaniment of laboratory work must result in abstract conceptions of a subject that has a very practical character.



PROF. H. O. HOFMAN.

The great gap that exists between the theoretical and practical aspects of technology matters with a strong leaning toward the abstract, forms the weak point of German technical instruction. We on our side sin somewhat in the opposite direction, in that we look too much at practice and not enough at theory; but our gap between the two extremes is small.

In recent years some of the German technical institutions have been accorded the privilege of awarding the degree of Doctor of Engineering to the regular graduates of technological schools after they have taken a post-graduate course of two years and prepared a thesis embodying a research which takes up most of the available time. The results of this work along metallurgical lines are seen in the splendid dissertations printed in the technical literature.

The teaching of the German schools may be said to accomplish two results, the training of an administrative engineer and of a theoretical engineer well qualified to advance his profession along scientific lines. It does not train the all-round man who is prepared to meet all sorts of emergencies, such as the practical engineer is sure to encounter in his profession in this country.

If the work demanded of the German and American professors be compared, there will also be found a considerable difference. A German can become a full professor only after having excelled in a special line of study. His whole preprofessorial life is therefore centered on becoming the authority in one specialty. The duties of lecturing take little time; the whole working power, which is really great, is bent upon exhausting a subject by investigation and by publication of the findings. The result is that unending stream of German publications in technical matters of which the conscientious, untiring thorough work of the young doctors of engineering carried on in the research laboratory, forms a considerable part.

In this country the leading duty of the professor is to teach the students, not simply to impart, but to see to it that the student learns what is being presented. He has, besides the classroom teaching, the laboratory teaching; further, he has to serve more or less in some administrative capacity or other. Very little incentive is given him for independent research work. If, nevertheless, he does an astonishing amount of it, it is accomplished only by working under high pressure if he is to meet on one side the official duties as a teacher and administrator, and to satisfy on the other the inward impelling force that drives him to make his contributions to the advancement of his profession. We see here, therefore, fewer contributions to the advancement of engineering than in Germany.

Given the conditions of work in both countries, is it advisable for a young graduate in mining and metallurgy to go abroad and study for a year or two before he enters his career here at the foot of the ladder? By way of introduction, the fact may be noted that from 1873-1877, when the writer was a student at the Royal School of Mines at Clausthal, Prussia, about one-half of the students came from the United States, and that when the old school was visited in 1890 not a single American was registered, but the foreign element was represented mostly by Englishmen, while the Germans were in the great majority. Similar conditions prevailed at the other famous school of Freiberg Saxony. The simplest explanation for this phenomenon is that the American had found in the meantime at home what was required and did not feel the necessity of going abroad. In the great majority of cases, this conclusion holds good today. For the small minority there are perhaps two clear cases. One is, that a student has been graduated at an age of say 21 or 22 years and has the means of passing one year in Germany. The advice to him would be, go by all means, you will learn the language, you will see different ways of attacking technical problems, you will get into different surroundings, be subjected to new influences, in one word, you will return a broader man and thereby better suited for your future career. The other case is one of a young graduate who has been at work in a branch of his profession for several years; he knows the practical side of it, has also carried on enough original research to be able to work independently. If there is at one of the higher institutions of learning in Germany a professor whose specialty is in line with the branch of the profession that the young man is following, the advice is to go to the professor and work in his laboratory, he will receive you with open arms and you will make a tremendous progress in your special branch of metallurgy.