

"At first the regular engineering college courses were used, modified to suit the alternating plan. *It is evident already, however, that both our courses of study and methods of teaching will gradually be changed to meet the needs of these earnest students.* For example, they are causing their instructors to give up traditional methods. The instructor in mathematics demonstrates a formula and then asks 'Do you understand that?' Quickly comes the reply, 'Yes, but what shall we do with it?' In the shop the student is handed a tool and taught to use it, and then return it to the tool-room. Handed a formula or theory in the University, he demands to be shown its use and application. The ordinary student will only hold it until examination time and then hand it back.

"The co-operative students often declare that if a thing has no practical application, it is useless to them. *The instructor is driven thus to hunt up applications of every theory.* This system has developed a new method of instruction which the students call the 'reverse quiz.' At the end of the hour the instructor gives them permission to ask any questions bearing on the subject, and he always finds this the most interesting, and often the most difficult, part of his work. *These things are rapidly demonstrating that much of the scientific and technical instruction given in our colleges is not only archaic, but out of place, and often entirely wrong.*

"From the administrative standpoint, 'The Co-operative Course in Engineering' is highly satisfactory. *The college saves all the expense of buildings, equipments, supervision, and instruction in extensive practice shops.* Consider what a vast plant the University would have to maintain if it provided itself the varied and excellent facilities given it free by the fifty great co-operating factories. The repetition of lectures, recitations and laboratory work does not cost much. In any case the large classes must be divided into sections. Laboratory facilities are used to better advantage when the sections alternate by the week, for the students work through longer periods and with less interruption. The only additional expense results from the repetition of illustrative experiments and general lectures which could be given to large classes.

"From the educational standpoint, the success of the co-operative course is most interesting, because it conforms perfectly to the latest theories. *No more effective scheme was ever devised for educating by real work for real life or for training men in schools for efficient service to society.* It promotes the heartiest sympathy and co-operation between the community and the school. An illustration of this in Cincinnati is the existence of an association of the co-operating manufacturers formed for the purpose of supporting the University in this and similar enterprises."

VIEWS OF THE DEAN OF THE COLLEGE OF ENGINEERING.

Professor Herman Schneider says of the plan:

"While there is no cloud on the horizon now, it is possible that a combination of unfavorable circumstances may work harm to the course. But we have operated it long enough to know that under normal conditions it is a good thing.

"It is believed this system of education will furnish to the manufacturer a man skilled both in theory and in practice, and free from the defects concerning which so much complaint is made. It is not held, of course, that this method of training will supply full-fledged, engineers aged twenty-three years or thereabouts; but it is believed that it will provide a better preparation, a stronger founda-

tion for the successful practice of engineering. The qualifications which the engineering graduate should possess will be more nearly attained. He will be just as thoroughly grounded in the fundamental principles of science as he is under present conditions, but he will have greater facilities in applying them to practical problems. He will be much more highly specialized, but not at the sacrifice of fundamentals. A knowledge of the achievements in other fields of engineering will result from his constant association with the best practice in electrical, mechanical, structural, and chemical engineering, as exemplified in the construction of the co-operating works, in their methods of power generation and transmission, and in their processes of manufacture, his attention having been called to these details in the classroom, and his observation of them having been checked by searching questions thereon. He will become familiar with business methods by constant contact with business conditions, supplemented by classroom instruction and practical talks on business law. He will obtain a knowledge of men by working intimately with all sorts and conditions of men in his gradual rise through the various departments of the co-operating plants. The cultural parts of his education will be planned to make him a man of good address and broad sympathies."

VIEWS OF THE CO-OPERATING MANUFACTURERS.

Charles S. Gingrich, M.E., Cincinnati Milling Machine Co., says:

"The chief criticism of modern technical education results from the fact that we try to take the shop into the school, whereas we should bring the school into the shop. The Co-operative Engineering Course plan practically brings the school into the shop. Our present schedule of half time during the school year and full time in the shop during school vacations, puts the boy in the shops eight months out of the twelve; in other words, during the six years he is taking the course, we have him in the shop four years—the same length of time that is served by our regularly indentured apprentices. The fact that these students are capable of taking the University course is in itself proof of their high quality, and men of their class will grasp the principles as well as the details of shop work very much more quickly than our regular apprentices.

"The shop work will include experience in: (a) machine shop; in several important branches, as lathe, planer, miller, vice work; (b) pattern shop; (c) foundry; (d) drawing room; (e) in some cases also stock and cost keeping, and in still others, sales work.

"While they are getting this, they will also be in close touch with the men and gain an intimate knowledge of the condition and attitude of labor, which will be of value to them later as managers of men in the shops with which they will become associated. These boys will also learn the commercial value of time. Do any of our present engineering graduates know that? *We are, therefore, giving these young men a thorough shop training while the University is giving them an engineering education at the same time. In this way we expect to mould each of them into a fully rounded out engineer—an engineer with an actual shop training obtained in a manufacturing establishment under regular shop conditions and in commercial work.*

"Now as to the direct value of it all. That man does not make the most efficient foreman or superintendent who does not know all the 'kinks' of the various trades under his supervision. He may be ever so efficient as an executive and have other necessary qualifications