## THE TRAINING OF ENGINEERS.

A number of interesting papers were recently read at a Convention on Education and Training of Engineers, held by The Institution of Civil Engineers. The following is abstracted from a few of the addresses given and presents sufficiently well the ideas of the speakers.

Discussing the requirements of practical training in works with the necessary complement of scientific study, Mr. W. H. Allen, M.Inst., C.E., pointed out the following :--

One is often asked, in the case of a student determining to go both to college and to works, which he should enter first. My views on this point are that a schoolboy coming direct to the works do not succeed so well or stand the same chance as the one who has been to college first. The latter has been better broken in, as it were. He has been formed in character by association with others of the same age in like pursuits, has learnt the value of time, and to recognize the serious side of life, and those qualities which tend to manliness, and has also received training in mental development. Much economy in time is also effected by preserving the continuity of study. I should therefore say that the man who sets himself the task of obtaining his degree before entering the works stands a much better chance of securing a higher and more responsible position in life than the one who is trained in the reverse order. The former not only takes a greater and more complete interest in the works and workshop life, but makes the most of his time, and grasps ideas and their principles much more readily than the man who comes to the works with merely a public-school training.

Another question frequently asked is, "How much study should a pupil undertake during the period of his practical training?" In my opinion, if a young man conscientiously does his duty from 6 o'clock in the morning until 6 in the evening, he will find that as much as his health can stand, without burdening it by further serious study at night. At the same time, unless some attention is paid to the work which has been done at college, this part of his studies is apt to lose its freshness and interest for him, his attention being concentrated purely on his daily task to the exclusion of everything else. My custom has been not to make this a compulsory part of the training, but to give lectures weekly explanatory of the actual work being carried on in the shops, thus greatly increasing interest in and adding to the knowledge of the work being done.

It must be remembered that the workshop to-day, involving as it does so many different classes of measurement, the use of instruments, and more elaborate styles of drawing—all necessitating a much higher educational standard throughout the works—requires a man of more thoughtful age and education to enter fully into his workshop apprenticeship than was formerly the case. A college training, moreover, must inculcate that habit of accuracy of thought which cannot be obtained in any other way.

As regards the requirements of workshop training, there seems little doubt that a period of 3 years—the actual time depending on the previous education of the subject—comprising a year in the drawing office, should be spent in the works in a not too specialized manner, that is to say, it should cover work in some or all of the branches of mechanical and electrical practice, which may be found in some of our better establishments. So long as this part of an engineer's training has to be carried out under commercial conditions, so long will it be more or less dependent on the state of trade and other local conditions. This is not altogether a disadvantage, for the alternating periods of exceptional activity in trade, and the reverse, will carry their own important lessons to the observant student. It will always be difficult, if not impossible, to lay down a plan either for scientific study or works' apprenticeship which will suit all, and each individual case will require consideration on its merits; at any rate, whatever plan 15 arrived at will have to be very elastic as regards the arrangement of details. I think we are inclined at present to attach rather too much importance to the direct value of scientific study as being the means of providing the student with certain mental tools for use in after life, and too little to the indirect side to which I have already referred, i.e, the development of the mental faculties generally, and the cultivation of a true scientific insight.

Without a systematic training, sole reliance must be placed either on continued experiment or on a highly developed instinct of discernment, in order to diagnose what must then be invariably regarded as phenomena.

Mr. William Barton Worthington, M.Inst., C.E., brought out in his paper on "Practical Training in Workshops or on Works Construction with Special Reference to Training in the Engineer's Office" a point that so many lose sight of namely, the fact that much training in certain branches does not make one a true Engineer. In brief, he says:-

"Mr. Ellington-dealing with the mechanical branch of the profession-in his Presidential address to the Institution of Mechanical Engineers, illustrated most excellently the need for the combination of the works training with office training in the education of the engineer. He says:-

"The great difficulty is to distinguish between a mechanical engineer and a good artizan on the one hand and the commercial man on the other. A very large number of men are employed in various capacities as managers, draughtsmen, engineers-in-charge, foremen and others who really have no ground for being considered mechanical engineers, but who in considerable numbers seek admission into out Institution."

During his term of office training whether he be there as a pupil or as an assistant under agreement to serve for a term of years, the man who is to become a civil engineer should have the opportunity of becoming familiar with as great a variety of work as possible. He must gain experience in draughtsmanship and design, specifying, costs and estimating.

On the other hand, the mere fact of being a member of the staff in an engineer's office will not train a man to be an engineer. He must, while in the office, see and deal with as many aspects and varieties of the work as possible, and he must above all have his training in or upon works, otherwise he may become a draughtsman, surveyor, clerk or commercial man, but will not become a civil engineer; just as, on the other hand, he may spend his time of training on or in works, and may become a skilled mechanic or a resourceful contractor, but without varied office experience he will not become a civil engineer."

In a paper on "Workshop Training as a Preliminary to other Training and Engineering," J. A. Brodie, M.Inst., C.E., says:—

"Probably all experienced engineers are to-day agreed that a period of practical training both in shops or works and drawing-office is of undoubted advantage to the engineer, much increasing the value of his services as an assistant, and adding to the weight of his advice and opinion at a later stage in his career. Important points for consideration are: (1) The class of workshop he should enter; (2) the class of work most likely to be helpful in his future career; and (3) the length of time which can be given to works and drawing-office training.

As the result of experience I am firmly convinced that the best type of workshop is one in which the materials used and the classes of work done should be as varied as possible.