May 11th, 1915.

"MILITARY FIELD ENGINEERING."

By the President, Prof. S. H. E. BARRACLOUGH
(M.I. MECH. E., ASSOC. M. INST. C.E.)

The President (Prof. BARRACLOUGH), in opening the proceedings, said he would like to explain, for the benefit of the Members of the Association (what, of course, the Council already knew), viz., that it had been decided that the Presidential Address which usually came at the first meeting of the year, should, on the present occasion, and possibly for future years, come at the end of the session rather than at the beginning. He might say it had been so arranged for this year, more particularly for his personal convenience, but it had also been discussed as to whether the contemplated arrangement would not be a better one for a permanency. All being well, he trusted to have the honor of addressing the members at the last session of the present year.

For this evening, it had been suggested that possibly the subject down on the business paper, viz., "Military Field Engineering," might be of some interest in view of the present situation, and his remarks would be illustrated by the aid of lantern slides. Taken as an all-round subject, "Military Field Engineering" was not in itself very exciting, except perhaps to those engaged in the actual practice of it, but it had been thought, under the circumstances now existing, that members who had

not possibly had occasion to look into the subject commonly known as "Military Field Engineering," might like to see some of the ordinary work which the military field engineer was charged with, the diagram and plans exhibited illustrating the various things that a military field engineer had to do in the actual field.

He would like to make it clear, in the first place, that what he was going to speak about was not engineering in connection with military work generally, because, as those present would very easily see, such a subject as that would be practically a description of the whole of the military operations, and a very large part of the practice of the profession of engineering itself. Nowadays, engineering, on the material side, was nine-tenths of the whole military operations. There was a large moral and personal side apart from the material equipment, but every year the engineering aspect of the military operations became more and more important. If one considered the great war that was at present proceeding, and took any part of it whatever—whether on sea or land—one would, of course, recognise that the engineer was actively engaged in every part. If one considered, say, a modern battleship, it was a perfect exhibition of the products of the highest skill in mechanical and electrical engineering in every direction. The 15-inch guns, which were at present doing so much execution, were marvels of mechanical skill and dexterity. In the wireless telegraphy equipment (which had practically made communication right over sea and land of the entire globe, and which had absolutely revolutionised operations in the way of getting quick information) would be seen one of the finest products of the

science of electrical engineering. The submarine was one of the extraordinary developments of mechanical science. The torpedo which it fired was, he supposed, in point of view of mechanical design, one of the most scientifically perfect, and technically interesting things that had ever been devised. On land, in the equipment of the military motor transports and in the aeroplane and dirigible system, one came across the products of the engineering genius of the various countries of the world. It was impossible to talk that evening about all those things, as each one of them would merit an evening to themselves. He supposed there had never been in the history of mechanical science anything to compare in rapidity of growth to the development of the air service. The possibility of navigating the air had come into existence, and the whole subject had been developed to the extraordinary pitch of excellence that it had now reached, within a period that would have been incredible even a generation ago. It was five years since he went down to pay some calls on various flying people, who, at that time, were considered expert exponents of the flying art; and when they considered what they were talking about, although it was considered something wonderful, what had been accomplished in the intervening five years was almost beyond comprehension.

He had had an opportunity of seeing a good deal of Bleriot, Latham, and Farman, who were big flyers in those days, Latham having the week previous to his visit been up, for the first time, 6000 feet; and, talking about the matter, Latham said there was not a doubt but that in a few years, as it was possible to get up to that height, the whole system of flying would be revolutionised—

people would be able to do long cross-country flights. Latham had been a safe prophet. In those five years, the development in the science of aerial navigation was something astonishing. He had had the pleasure, in Stuttgart, of seeing Count Zeppelin, who was about 70 years of age, and who was a kind of first-citizen of the city. He was a very nice old gentleman to talk to, and extremely interested in German dirigibles, and his interest in the progress of all countries appeared to be in that one direction. Hearing that he (the Chairman) had come from Australia, and talking at the same time about the topography of the country, Count Zeppelin asked if there was not a large range of mountains on the East Coast of Australia. He (the Chairman) replied that that was correct, upon which Count Zeppelin remarked that that would be very easy—they could easily get over that. He (the Chairman) then introduced the subject of aeroplanes, thinking that it would interest Count Zeppelin. At that time a great controversy was going on, as there was now, between the different classes of flying machines, and he (the Chairman) was very much amused when Count Zeppelin shrugged his shoulders and said he had, unfortunately, never seen one; which made it quite clear as to what his views of the relative merits of air craft were.

The members present would, no doubt, have noticed in connection with the subject for that evening's discussion, that he did not call it "Military Engineering" because that subject covered a great deal of ground not included in the work of the military field engineer—there was a great deal done by a military engineer which was not carried out in the field. There was not sufficient time at his disposal to talk about the enormous amount of railway work which, since the war

commenced, had to be undertaken by the military engineer, and the enormous transport services which had to be organised. It was an open secret, that, with reference to the even relatively small expeditionary force sent from England to France at the beginning of the present war, it had taken between seven and eight days' work on the railways in the United Kingdom to concentrate this force, and get it into a position to be carried across the Channel. From that, it would be appreciated that the railway work formed a large branch of military engineering.

The telegraph work was another big section entailing an enormous amount of what might be regarded as ordinary engineering work. He did not propose to deal with any of those things that evening, but to confine his remarks to what was done by the military engineer when he was in the field. With regard to the term "Civil Engineer,' although it was now regarded as being more or less a term applicable to the carrying out of public works, a "civil" engineer was simply the other kind of engineer as distinguished from "military." There were originally two classes of engineers—one civil, and the other military. The work of a civil engineer originally included all branches of engineering other than military, and it was only in later days that a distinction had come to be drawn between a "civil" engineer, a "mechanical" engineer, and an "electrical" engineer.

When one thought of the actual work of the engineer in the field, one ought to keep in mind the general lay-out of the theatre of operations, and it would be appreciated that, in addition to the fighting line, there was

a long series of lines known as lines of communication, all radiating from one base of supplies, or possibly more than one base; and, in the case of Great Britain, fighting outside her own territory, the base was practically always a seaport. On the lines of communication there was a good deal of work to be done, which was largely similar to the work of the ordinary engineer, but as soon as one got near the actual fighting line, one came in contact with work more commonly described as that of the "Field Engineer"—that is, work carried out by engineers known as field companies, and as field troops, the one being dismounted men, and the other mounted men.

With that general statement, he thought that probably it would be more interesting if his audience were shown a series of slides, on the screen, which had been used in connection with the Military Science Course of Engineering at the University.

Commander G. H. Bromwich, in proposing a vote of thanks to the lecturer for his interesting remarks, said that he was sure all present would agree that the subject presented to them that evening had been a most absorbing one, but it was a matter which could not be very well discussed, because it was rather apart from the work of the ordinary engineer. Speaking for himself, he would have liked, if it were possible, to have heard a little more about demolition—whether there was any system of getting rid of barbed wire, and so on. As regards military engineering, he thought the lecture, and the photographs exhibited on the screen showed what an interesting science it was. If it was not a very exact science, owing to the time and material available, as the lecturer had

remarked, it was perfectly wonderful what the military engineer of the present day had to do, and accomplished, compared to what it was in the past.

Mr. SHIRRA said he had much pleasure in seconding the vote of thanks proposed by Commander Bromwich for the interesting lecture the Chairman had given, illustrating many matters which were constantly being questioned about, and wondered about, such as the size of trenches and the drainage of trenches. The engineering operations carried on in the present war covered such a vast amount of space, and affected so many nations, that it was, he thought, quite impossible to get any clear idea of what was going on. When the history of the present war came to be written, he felt sure that one of the most interesting chapters would be that on the operations in the Suez Canal, where the Australian engineers had done good work, and where the Turkish and German engineers had done very bold work. The extraordinary notion of bringing pontoons across the desert, and carrying water in them, and launching them in face of fire, showed a considerable amount of courage.

With reference to sand, he would like to know, when building cover behind a sand-hill, what thickness of sand would be needed to keep a sharp-nosed bullet from penetrating.

THE CHAIRMAN (in acknowledging the vote of thanks) said it was very kind of the members present to have taken his remarks so leniently.

With regard to the question that Mr. Shirra had raised as to the thickness of sand which would be required in order to stop a bullet from penetrating, experi-

ments had been made at Randwick Rifle Range with bags of sand of a thickness of 6½ to 7 inches at the outside. If a bullet was fired from a rifle at a distance of 10 yards away, it could by no possibility go through 6½ or 7 inches of sand—it refused to go through, and was always found in the sand bag. At a distance of about 300 or 400 yards, it could be made to go through a sand bag of about 10 inches in thickness instead of 6½ inches. The thickness which was allowed, so as to have a margin of safety, was usually 30 inches.