

tunneling, bridging, demolition, the supply and manufacture of the necessary engineer stores, and the construction of accommodation for troops and horses. Let us examine these in greater detail:—

As to defences, the general policy governing them—their nature and siting—was laid down by the general staff. They were constructed under the supervision of the engineers—in divisional areas under the officer commanding the engineer brigade, and in the corps area under the chief engineer.

Defences include wiring. In the early days the wire was strung along wooden posts driven into the ground by a mallet. Often one could hear the enemy pounding their sticks in. The question immediately arose as to whether it was advisable to shoot up their wiring party with machine guns, or to get out and get busy ourselves. We usually adopted the latter plan until we got out a fair amount of wire in front of our immediate front line. The wooden posts were soon replaced by wire screw-stakes, which had the advantage that it was possible to put them in place without the enemy hearing what was going on. In addition to the wire stakes, we made up "knife-rests," so called because the framework resembled a knife-rest. They were made up in the rear, brought up at night and thrown over the parapet.

Wiring

In the beginning, the wiring was done by the engineers and special wiring parties, known as the "Suicide Club"; yet, strange to say, although these men often worked in "No Man's Land," their casualties were few. In latter years every man was trained in the art of wiring—trained in squads of ten. We knew exactly how much wiring a squad of ten men could put up in so many hours, working either by day or by night. I have seen remarkable demonstrations of rapid wiring. I think a squad of ten men can put up 50 yds. of double-apron wire in some eight or nine minutes, and battalions did not take long to wire themselves securely.

In the Lens area, where the corps was for many months, we erected hundreds and hundreds of miles of wiring. In front of our second line there were seven belts of this double-apron wire, and in front of our main line another seven belts. The wire was not put up in haphazard fashion, but was erected in relation to the machine guns which covered it. If you saw a long belt of wire stretched out in one direction, you knew that there were machine guns sited so as to sweep that wire. There is nothing which holds up troops as quickly as barbed wire; and during the war many unnecessary casualties were caused by troops being ordered to attack when the wire had not been sufficiently cut. This cutting of wire was a difficult operation until the advent of the .106 fuse. One of the great advantages of tanks was that they were able to cross uncut wire, crushing it so that the infantry could follow at once. The tanks were fitted with grappling-irons which pulled the wire completely aside.

Trenches

After barbed wire comes trenches. The first thing a soldier cares about after reaching a position is digging himself in, and for this purpose he is provided with what is known as an "entrenching tool"; yet it was often the custom to send in with troops about to make an attack a certain proportion of spades and picks. If not sent in with the troops, they were got up as soon after dark as possible. In many parts of Flanders it was impossible to dig trenches, the water lying so close to the surface. Trenches were constructed in those areas by filling sand bags and piling them up, one on top of the other—a very unsatisfactory method. They were soon pounded to pieces by shell fire, and the bags rotted after being exposed to wet. The piling of sandbags is an art, and many troops suffered much discomfort from the imperfect way in which the work was often done. All who have served in France know what is meant by sandbags "slithering in."

When we were in an area where trenches could be made we dug down, at first making our trenches deep and narrow; but the winter of 1915-6 cured us of that folly. We then

made them much wider and took care that they had a proper berm. Although the narrow, deep trench gave greater protection from shell fire, the wide trench permitted much more rapid movement.

In connection with the building of trenches a proper system of drainage had to be put in, and "bath-mats" had to be laid. The trenches were revetted,—chicken wire, corrugated iron and hurdles being used, the last being the most satisfactory. When trench was revetted with corrugated iron, after a severe shelling it required a great deal of work to get it into any sort of decent shape again.

Dugouts

Leading from these trenches were the dugouts for the garrison. The Germans taught us all we knew about the construction of dugouts. Until the battle of the Somme was fought, ours were principally of the "Old Bill" type, viz., a square excavation in the side of the trench, covered with corrugated iron and a layer of sandbags. When we overran the German trenches at the Somme we found dugouts quite 30 or 40 ft. below the surface, and often leading down to a second tier of dugouts. These were often lighted by electricity and could be made very comfortable. You can readily understand the technical training the engineers were required to have in order to construct these dugouts. We aimed at providing sufficient protection for the troops in the trenches and dugouts, and all our outposts, headquarters, signal stations and report centres were similarly protected.

These dugouts often became, in a battle, death-traps for their inhabitants. A severe shelling previous to an attack forced the garrison into the dugouts, and we aimed at our infantry arriving in the hostile trenches before the defenders could emerge from them. If the interned garrison did not immediately surrender, bombs were thrown down and mobile charges exploded, blocking the entrance. In an attack special parties were told off to deal with any of the enemy who might be hiding in the dugouts. These parties were called "mopping-up parties."

Subways and Gun Emplacements

With the dugouts go the subways (underground passages from support lines to the front lines), which we constructed when we had time so as to avoid having to come out of the trenches. Before the battle of Vimy we had been able to construct a great many of these subways. One division, I remember, had a light railway installed, and was thus enabled to get all its bombs, trench mortars and other ammunition, supplies, etc., up to the front line without exposing the carrying party to the dangers they would be subjected to if forced to go above ground. In our defence of Hill 70 we were making the subway the backbone of the defence. This subway, besides providing safe passage to the front, also gave safe living quarters to the garrison, and from it stairways led to machine-gun emplacements, carefully camouflaged along its entire length. It was compartmented in order that access to one part of the tunnel would not mean that the whole thing was permanently lost.

Following wiring, trenches, dugouts, etc., come machine-gun emplacements. During the war there was a great advance in the tactical employment of the machine-gun. At first, the emplacements were simply open emplacements with no other protection than what the ordinary trench afforded; then we sought to give them head-cover protection from shrapnel. This was simply a rude structure covered by sand bags. With the increase in the employment of high-angle guns came the necessity for further protection; and by the use of I-beams, heavy timbers, sand bags, etc., we were able to provide it to a certain extent. Naturally, a demand for cement arose in the making of these emplacements. But the British army did not make many cement machine-gun emplacements owing to the lack of cement. Much of the product of our factories went to Holland, where it eventually found its way into the German front areas.

The enemy employed this type of structure to a large degree; along the Hindenburg line from Neuville Vitasse you could count cement machine-gun emplacements every